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ABSTRACT

Part two of a seven-section, final report on the Multi-Disciplinary Graduate Program in Educational Research, this document contains discussions of quantification and reason analysis. Quantification is presented as a language consisting of sentences (graphs and tables), words, (classificatory instruments), and grammar (rules for constructing and interpreting tables). More detailed examination of each of these "language" units is undertaken to explain other components of quantification systems and, using this basic vocabulary, sources of quantification and the combining of elements into charts and graphs are examined. The section concludes with a series of exercises in reading and constructing percentage tables. Section three of part two discusses the concept of reason analysis, a method for discovering and evaluating the causes of individual's dispositions and behavior in situations where findings from typical cross-sectional analyses are rendered insignificant by the gross difference between the number of actors and non-actors. Such situations would include consumer behavior, migration, occupational choice, marriage and divorce, voting, delinquency, and others. (A second section by Alice Troue on qualitative methodology is currently under revision and is not included in this final report.) (MB)

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TABLE OF CONTENTS

II. Methodological Trilogy
A. Quantification as Language with Accompanying Exercises
B. Qualitative Methodology (Under Revision; not included for publication)
C. Reason Analysis: An Expository Review

QUANTIFICATION AS LANGUAGE

The relation between quantitative and qualitative analyses requires an understanding of quantification in a very specific sense: how can figures be used to express ideas? Quantification as a language, and not as a philosophical nor as a mathematical problem, is the topic. In this paper, quantification will be exemplified through tabular displays of numerical data. A language consists of words and of rules or grammars by which they are combined into meaningful sentences. In the language of quantification, classificatory instruments correspond to words, tables take the place of sentences, and rules for constructing and interpreting tables constitute its grammar.

Classificatory instruments are the tools whereby concepts or objects in the world are translated into meaningful numerical representations. The term "variable" will come to mind for many readers; but for our purposes, the word is too reminiscent of the natural sciences where properties of objects are measured on a continuous number scale. The social scientist often deals with quite simple distinctions, e.g., dichotomies such as male-female and high school graduate or not; often he deals with ratings or rank orders established on a very intuitive basis -- grading of essays, ranking of applicants for jobs. Rarely does he deal with variables in the strict sense: income in dollars, or age in years and months. All these classificatory devices will be called "variates", and variables are only one specific kind of variate. The general term is somewhat unusual but it is used rather consistently in the following pages to give it greater currency. Sometimes to ease the language, terms like "index"[1] or "measure"

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[1] Strictly speaking, an index is a combination of variates forming a new "higher order" variate. For example, variates for education, income, and occupational status may be combined to make an index of SES (socio-economic status), a new variate.

are also used; but such terms are always meant to be synonymous with the notion of variate.

Variates cross-classified under certain rules form a table. Tables and variates are introduced here simultaneously. A table combines variates in such a way as to display information about their contingent properties. But a series of tables, if they are to be compared with each other, leads in turn to new variates. This increasing complexity is paralleled by the complexity of the objects which have to be studied: people, some homogeneous groups, large organizations. These complexities are introduced stepwise although we stop at a quite elementary level. More intricate material is relegated to the exercise book, but even there, quantification is always approached as a language which doesn't require any formal apparatus.

Aspects of Quantification

We have identified three components of quantification as a language - variates, tables and rules. Within each component we can identify more detailed aspects of quantification as follows:

I. Aspects of Variates

With regard to the construction and analysis of variates we can identify several principal aspects. Of special interest to us in the discussion which follows are units of analysis, data sources, elements and indices, and time.

II. Aspects of Tables

The aspects of tables to be discussed are listed below. We shall examine tables which differ with regard to their dimensionality and the types of number displayed.

Dimensionality (number of variates)

Numerical Representation
.raw figures
.percentages
.scores
..index scores
..correlation coefficients

III. Aspects of Rules

Finally, two aspects of rules are shown below. We shall be less concerned with rules here than in the exercise book. For the most part, relevant rules will be implied in the examples, although we shall deal explicitly with tabular representations of dependence relationships among principal variates and ways of controlling for the influences of extraneous variates.

Dependence Structure (Causal Imagery)

Controlling with Stratifiers

In the remainder of this paper these selected aspects of quantification are exemplified in tables from various studies.

We begin with a table taken from V.O. Key's book, Public Opinion and American Democracy. Table 1 is intended to show that people who identify strongly with unions also feel a strong involvement with party politics. The whole table can be described in at least eight ways in accordance with the preceding discussion. These eight aspects will provide the map for my discussion.

TABLE 1

SENSE OF UNION IDENTIFICATION
IN RELATION TO LEVEL OF
POLITICAL INVOLVEMENT

		Union Identification			
		Least Identified			Most Identified
		1	2	3	4
Political Involvement	High 4	17%	14%	26%	34%
	3	19	29	24	23
	2	36	33	26	31
	Low 1	28	24	24	12
		100%	100%	100%	100%
	N	83	126	109	110

1. Its basic units are 428 individuals. Similar tables could be constructed by taking eggs as the unit and tabulating their length against their width. Of special interest for social scientists are units which we shall hereafter call collectives: organizations, communities, countries, nations, etc.

2. The sources of data is another basic aspect of the measurement problem. The variates by which the units are characterized come from questions answered by respondents. Instead of asking questions, Key could have observed their behavior, although this would have been more complicated. In other studies, existing records have been used for the formation of variates.

3. To describe "union identification" two questions were used: whether the respondent felt "pretty close to labor union members in general" and how much he or she cared about "how union people as a whole are getting

along in this country." The respondents could say that they cared very much, somewhat, or not at all. A similar procedure was used for the variate of political involvement.[2] We shall call the answer to each question an element (sometimes called an indicator). Other types of elements could be interactions observed in a field study, prices exhibited in food stores, entries taken from office files, etc.

4. When different elements are combined into one variate as in Table 1 we shall call it a scale or an index. The way such combinations of elements are performed can vary considerably. The choice of elements and their construction translate conceptual ideas into classificatory instruments. They form the vocabulary of the variate language. The tables are equivalent to propositions.

5. The information on which the table is based was obtained at one specific moment in time, the time before the presidential election of 1956. Had he been interested in change in either of the variates or their relationship, Key might have interviewed each person twice in order to see what changes come about; for instance, at the times before and after the nominating conventions.

6. Table 1 cross-tabulates only two variates. It is obvious that we could have tables with multiple variates by distinguishing, for instance, the sex of the respondents and their party affiliation or by adding more attitudes. How to handle many variates is a central problem of multivariate analysis.

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[2] The elements constituting political involvement were a) whether or not the person cares "a great deal which party wins the presidential election this fall" and b) the degree to which the person is "interested in following the political campaigns so far this year."

7. Each cell of the table originally contained a figure which was simply the number of individuals who had both some level of union identification and some degree of political involvement. For example, the top left-hand cell containing "17%" originally held the "raw" number 14 - the number of people who identified least with the union and who had high political involvement. Key chose to compute percentages from the raw data in order to make comparisons on which to base statements about the relationship between the variates. As is, the table shows, for each level of union identification, the percentages of the total with each degree of political involvement. One can find tables from other studies that are percentaged in different ways or which are not percentaged at all. We shall examine tables later which contain other sorts of numeric data (index scores or correlation coefficients) as cell entries.

8. The table in the form reported by Key implies a dependence relation or causal structure: it indicates that the more people identify with the union the more they are politically involved. This is also paralleled by the text where the author speaks of "a hard core of members who are closely identified with the group and who in turn are most active and most involved in political matters." The relationship is demonstrated numerically by comparing percentages in each row. The percentages of people who are highly involved increase as one reads from least to most identification; conversely, the percentages of people with low involvement decreases from least to most union identification. Obviously one could interpret the table in a different way: the more politically involved people are, the more likely are they to involve themselves with a relevant political group: unions, women's liberation, civil rights movements. If that had been the author's hypothesis, he would have tabulated the raw figures so that the

rows, and not the columns, add to 100%.

By looking at a table in this way we can exemplify the main aspects of quantification in the social sciences. To fix the meaning of the eight points more clearly, let us subject another table to the same scrutiny. The table comes from a study by David Sills (1957) done for the Polio Foundation at the time the Salk vaccine was invented. The foundation was wondering whether the network of volunteers and contributors it had built up could be transferred to other social causes. One of the problems Sills wanted to study was quite similar to V. O. Key's concern. To what extent did awareness of the polio problem contribute to involvement with foundation activities? Following Key's example, one might construct two scales, one of which asked people what they know about polio and the other, how willing they were to support the foundation's work. For a variety of reasons, however, the author proceeded quite differently.

Sills wanted to show that the awareness of polio in a county together with average per capita income would determine the amount of per capita contributions to the Foundation. Several different aspects of quantification arise under this conceptualization of the problem. For one, his unit of analysis was not individuals but counties of the U.S. (point 1), and he collected data on counties from Foundation records (point 2). These aspects are in contrast to Key's study where individuals were studied using questionnaire responses. Other differences pertain to the indicators employed.

Sills argued that people would be aware of polio in counties where the incidence of this illness was high. Accordingly, he chose to use the incidence of polio in a county as an indicator of awareness. The other necessary indicators were median family income and per capita contributions

for each county. Thus, for each concept, only one indicator was used as a variate, not a scale built from many items as in Key's study (points 3 and 4). The relationship among these variates is displayed in Table 2. Notice that "Family Income" and "Polio Incidence" have been reduced to three categories (high, medium, and low) while "Contributions" has been divided into two categories on the basis of whether or not the chapter received more than 34 cents per capita on their March of Dimes drive. To simplify the table I have included percentages for only one category of the latter variate - those chapters obtaining per capita contributions in excess of 34 cents (for this reason, none of the percentages adds to 100%).

TABLE 2

PERCENT OF COUNTIES RAISING OVER 34 CENTS PER CAPITA FOR POLIO

Median Family Income of County	Polio Incidence of County*		
	High	Medium	Low
High	75% (253)	57% (384)	54% (83)
Medium	64% (484)	35% (793)	25% (298)
Low	29% (54)	4% (406)	3% (318)

*Figures in parentheses indicate the total number of counties on which percentages are based.

Table 2 shows the relationship between Polio Incidence, Contributions, and Family Income. The author might have simply considered the relationship between Polio Incidence and Contributions in order to test whether higher contributions were more frequent where the incidence of polio was

greater. Such an approach would have been consistent with the research problem, but any causal implications made from the relationship would not be persuasive. Counties differ with respect to median family incomes; obviously, richer counties are likely to yield more contributions to the March of Dimes. Therefore it was necessary to "control" for the economic level of the counties to demonstrate that the relationship between Polio Incidence and Contributions obtains regardless of Median Family Income level. This was done by classifying the counties once more into three groups according to the median family income. Consequently, we now deal with three variates instead of two (point 6). In each of the nine cells of Table 2 we now have the number of counties as the so-called base figures the incidence of polio, and the percentage of chapters where the per capita March of Dimes contribution was over 34¢ (point 7).

As a result, the causal imagery is also more complex (point 8). Reading across the rows, we do indeed find that higher contributions are consistently more frequent when polio occurs more frequently; this answers the original question on the relation between involvement and concern. But we can also read Table 2 down each column; we are not surprised to find that richer counties make higher contributions. It is a worthwhile by-product of such a three-variate analysis to see that the median income of a county has a greater effect on contributions than does the frequency of polio.

In seven respects then, the measurement aspects of Table 2 are different from Table 1, in spite of the fact that their substantive character is quite similar. But in one respect the two tables are alike; they both deal with cross-sectional data at one point in time. Of course, Sills could have studied whether in specific counties the annual changes in

contributions paralleled the annual variations in polio frequency. However in the present example, the matter of time does not enter the picture (point 5).

We shall now discuss in more detail two of our eight points, the sources of quantification (point 2) and the combination of elements (point 4).

Data Sources

Key got his material from interviews where the respondents knew they were involved in a study. There has recently been an increased emphasis on so-called unobtrusive measurements. The idea is not new. During Prohibition you couldn't ask people how much they drank; but you could count the number of bottles they had discarded in trash cans. A volume on the use of such indirect indicators has been published by a group of social scientists from Northwestern University (Webb, et al., 1966). The methods proposed suggest a variety of data sources: Which pages in an encyclopedia show an unusually large number of fingerprints? Where in an exhibition is the carpet especially worn out? What possessions are people least willing to forego in times of depression? What is the ratio of ministers to lawyers in various American communities? In the United States, business tycoons have unlisted telephone numbers, while in France it is the professors who use this device to avoid the horror of contact with students.

Such "unobtrusive measures" are at the moment also of practical importance. Government agencies who give grants often request that no direct interviews be made. This puts a special load on the ingenuity of the investigator. It also increases the role of informants, the person who supposedly knows what's going on in the community and is a reliable

source of information. The early studies done in Europe during the nineteenth century on the situation of industrial and agricultural labor were mostly based on information obtained from local officials or professionals. It was assumed that the poor people themselves could not answer questions. Informants, for a long time, also remained the main source of data for the anthropologist. Slowly sociologists convinced them that they should use sampling procedures and direct contact with the population. Today the tables are turned and sociologists have to worry more about the systematic use of informants. This makes it desirable to study what biases informants might introduce. Here is an example from The Academic Mind (Lazarsfeld and Thielens, 1958), a nationwide study of university faculty members' attitudes during the McCarthy era. The professors interviewed were partly used as informants in order to determine what incidents happended in the 150 colleges sampled, how the administrations behaved, and so on. A lengthy appendix to the publication analyzes how the personal attitudes of the professors affected the information they gave. It was found that their reports were more consistent the smaller their college was. Their appraisals of the academic situation in their colleges were, of course, affected by their own attitudes. The more apprehensive they were, the more critical were they of the administration, and the more tokens of danger they reported. Comparing information across schools, the correlation between the reports of more or less apprehensive teachers was very high indeed. The two groups of informants singled out the same colleges as tranquil and turbulent respectively.

An interesting version of the informant problem is what one might call "segmented information." It comes about when, in a study of groups, we confront differences in data obtained from different subgroups. Stouffer,

in The American Soldier, wanted to know whether the morale of army platoons is related to the kind of food the soldiers get. In such an inquiry, there is obviously danger of a halo effect with the direction of the relationship reversed -- soldiers of low morale would also describe the food as bad. To guard against this, Stouffer split his information. The enlisted men filled out a questionnaire describing their own state of mind. The rating of the food was done by the non-commissioned officers. A sizeable positive correlation between morale and quality of the food was found using platoons as the units of the statistical computation.[3]

Archives and documents are paramount sources of data. The training of historians has always included criticism of such material. In contrast, sociologists have been more concerned with material they collected themselves and relatively non-critical of documents. They felt they were on safe ground with archival data and could use them without too much scrutiny; but this position is becoming more and more questionable. One of the sacred books in sociology is Durkheim's study of suicide based on official record. It found that Catholics commit suicide less frequently than Protestants, and this Durkheim explained by the greater cohesion and moral integration of Catholic groups. But this might be a fallacious finding attributable to a non-critical acceptance of the data. That is, in groups where suicide is considered especially sinful or shameful, the family of a deceased person makes every effort to conceal the fact of suicide. (Of course, one can counter that this very fact of concealment is an indicator of group sentiment and that basically the Durkheimian interpretation would not be altered.)

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[3] This type of finding will be discussed further in the section on organization measurement.

One may check the reliability of data by comparing different sources for the same information. The field of public health provides examples of this method. In sampling surveys people tell us about their health problems; their stories can often be checked by hospital records. In the case of death, a reported cause can often be matched by autopsies. Haberman (1964) reports 10% to 30% disagreements in studies matching reported cause of death with autopsy findings. In political sociology people's voting claims can be checked against the registration list to show whether they voted at all. Here it is not only the fact of a discrepancy but the question of who deceives which is important. It seems, for instance, that people who are especially interested in politics but who were, for some reason, kept from voting on election day claim to actually have voted. From some points of view their "cheating" might not be a distorting factor.

Occasionally authors may use rather ingenious methods to combine different data sources. Two examples rather similar in kind but distinct in type come to mind.

Robert Angell (1951) developed an index of moral integration based on two kinds of regional data: the amount of per capita philanthropic contributions and the crime rate. But this information was not available on all cities under study. He therefore wanted to find information which was available for all cities and could be used to "predict" his integration index in cities where the data was missing. He found that residential mobility and ethnic heterogeneity were highly correlated with his integration index. He therefore used a weighted index of these two census data as a substitute for the index, the weights having been developed by regression analysis for those cities where all information was available.

About ten years later, Otis Duncan (1961) used the same method to classify all occupations in the American labor market according to their prestige. On a few scores of occupations, direct prestige ratings from public opinion surveys were available. For these occupations he computed how well the actual prestige rating could be inferred from what was known about the average education and salary level. For those occupations not included in the opinion survey he used the ratings as substitute measures of prestige -- thus greatly increasing the number of occupations on which he could base further studies.

The Combination of Elements

The simplest combination occurs when we deal with a set of dichotomies and add up "positive" answers -- the meaning of "positive" depending upon the subject matter under investigation. A typical example is an examination scored according to the number of questions answered correctly. Sometimes attitude tests take this form.

Rosenberg (1957) developed a "faith in people" scale consisting of five questions.[4] One of his results was that the higher students scored on this scale, the less likely were they to choose profitable occupations. The respondents were given a list of "occupational values" which contained

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[4] The five items were:

1. Some people say that most people can be trusted. Others say you can't be too careful in your dealings with people. How do you feel about it?
2. Would you say that most people are more inclined to help others, or more inclined to look out for themselves?
3. If you don't watch yourself, people will take advantage of you.
4. No one is going to care much what happens to you, when you get right down to it.
5. Human nature is fundamentally cooperative.

"chance to earn a good deal of money" as one of a number of desirable aspects of a job. Table 3 shows the percentage who give this as their first choice for each of the six categories of the "faith in people" scale:

TABLE 3

RELATION BETWEEN "FAITH IN PEOPLE" AND MONEY AS A TOP OCCUPATIONAL VALUE

	Faith in People					
	Low					High
	1	2	3	4	5	6
Percent Scoring money as top value	19%	16%	12%	7%	6%	2%
Number of cases	72	162	245	356	427	213

A scale can also be applied to collectives. In The Academic Mind, colleges were classified according to their quality. The following items of information were available: books per students in the library; budget per student; proportion of Ph.D.'s on the faculty; proportion of graduates who went on to graduate or professional schools. The distributions of these items for all colleges were obtained and each was cut into five parts with about equal frequencies. Each college was correspondingly rated from one to five on every characteristic. The five ratings were then averaged and used to classify schools into one of four quality levels (as shown in Table 4). The procedure might appear primitive but it can be useful. In Table 4 the colleges are also classified according to the number of incidents which occurred there -- accusations, investigations, dismissals, etc. It can be seen that the higher the quality of the college the more likely was it that a faculty member was attacked for "subversive" activities.

TABLE 4

PERCENTAGES OF ACADEMIC FREEDOM INCIDENTS
IN COLLEGES OF DIFFERENT QUALITY

	High	Medium High	Medium Low	Low
0 incidents	3%	--%	23%	26%
1-9 incidents	49	62	67	74
10+ incidents	48	38	10	--
	100%	100%	100%	100%
Total number of cases	(31)	(39)	(64)	(31)

A major objection to this simplest type of combination of elements is this: are not some of these elements more important than others? This matter can be handled in a variety of ways using "weights". In forming the "score" we can say that certain elements should count, say, twice as much as others; the decision can be made by the judgment of the investigator or by statistical procedures, the basis for which goes beyond the scope of this presentation. Another possibility is to let the respondent make an implicitly weighted decision. In the score of "people mindedness" we could, for example, ask whether he agrees strongly, somewhat or not at all; the variates in Table 1 were based on this idea. In other cases the elements themselves suggest weights. The famous Coleman Report (1966) describes the quality of high schools by elements like the existence of a chemical laboratory; the objection has been made that the laboratories themselves should be weighted by their quality.

A final aspect of combining elements concerns the distinction between individuals and collectives. We have so far treated collectives and individuals as if they did not lead to different problems; actually they do,

as we shall see. But one more similarity deserves emphasis. Suppose we are interested in characterizing individuals according to their "mood pattern." We might start with a simple rating scale asking them to locate their mood at the moment somewhere between very happy (+3) or desperate (-3). If we repeat this inquiry, say, every six hours, we could characterize each person according to his average mood, his mood swings around the average, whether the range of the negative extremes are larger than the positive ones, etc.

We have a similar choice if we deal with a collective - a set of people selected for some purpose. We can ascertain for each person, say his income; then the group can be characterized by the average income of its members. We can ask whether income differences are large or small, whether there are some superrich people included and so on. Thus, similar averaging methods can give rise to both individual and collective variates. But now we have to be more precise about the relation between "individual" and "collective" variates.[5]

The Structural Classification of Variates

Sociologists often emphasize their independence from psychology. While it is true that social psychology is a contested buffer state, at the extremes, the difference between sociology and psychology can be readily described. Both disciplines want to explain human behavior, and their common goal is to locate underlying forces which take them beyond

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[5] We introduce a linguistic barbarism in order to distinguish variates which characterize individuals from those which pertain to collectives. An individual variate is a variate representing characteristics of individuals; a collective variate is one characterizing collectives.

folk-knowledge explanations. But the psychologist sees man pushed about from within by his unconscious motives or the reflexes to which he is conditioned. The sociologist sees man controlled from without, and for this invisible social force, he likes to use the term "social structure." There are many definitions for this term, but the function of the notion is to carry explanations of individual behavior by reference to social units of higher complexity. Personal lives are affected by bureaucratic organizations, by the density of the city life, etc.

In the early phases of quantification, the tendency was to create collective variates by aggregating information from individuals: average income, average years of schooling. This seemed rather far away from the sociologist's professed concern with social structure. (Someone commented when Stouffer's American Soldier appeared that it couldn't be true sociology or it would have been called The American Army.) In recent years studies introduced variates of ever greater social complexity. Individuals were characterized in relation to a larger collective; and collectives, once they entered a quantitative proposition, required the development of what we called "collective variates". This development stimulated many convergences between traditional social theory and the interest in quantification.[6]

For "individual variates" the consequences have been analyzed elsewhere in considerable detail, so that a brief summary of the main ideas should suffice here. First, we can characterize people through direct individual variates - their income, age, etc. But often variates require

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[6] The word "collective" is used to cover face to face groups as well as larger units like a city or even the Polish voters in a city. For the context of the present discussion these substantive differences are irrelevant; later on we shall make finer distinctions between collectives.

information about a group member's relation to the rest of the group; a popular pupil is one who is liked by his peers. Here, we are dealing with relational individual variates. Finally, people can be characterized by the collectives to which they belong. The pre-school boy and the organization man are well known stereotypes. When these organizational characteristics are more carefully spelled out we shall talk of contextual individual variates.

An example covering all three types can be found in Coleman's Adolescent Society. The units in Table 5 are boys in a number of high schools. The boys are divided according to whether they attend high schools which emphasize academic matters or schools where sports, rather than learning characterize the social climate. (The classification was based on yearbooks and reports of informants.) This climate is clearly a contextual variate. The boys are further classified according to their popularity. This is a relational variate, because the choices of all other boys are involved in the determination of the popularity rating. Lastly, each boy was asked whether he wanted to be admired for his scholastic achievement. His response involves only himself, so this is a direct individual variate.

TABLE 5

PERCENT OF BOYS WANTING TO BE REMEMBERED AS A BRILLIANT STUDENT IN SCHOOLS WHERE THE REWARDS FOR ACADEMIC ACHIEVEMENT ARE HIGHER AND IN THOSE WHERE THESE REWARDS ARE LOWER

	All Boys	Those Mentioned 10 Times or more as Members of Leading Crowd
"High" Schools	35.1%	24.0%
	(2,781)	(108)
"Low" Schools	27.2%	9.5%
	(1,578)	(74)

The substantive finding of the table is twofold. First, by comparing the two columns, we find that the leaders are less scholarly-minded. In both types of schools if you want to be popular, you should not be too much of a "greasy grind." But secondly, the difference between leaders and followers is much greater in what Coleman calls the "low quality" high schools.

We now turn to collective variates. Collectives consist of "members" as subunits. Members might be people like the professors at a college; they might be collectives themselves like departments; or they might be functional subdivisions like teaching staff, administration, clerical and maintenance personnel. Also, we will sometimes have to distinguish "levels of membership" -- a city is a collective of districts which themselves are a collective of citizens. We shall for the moment think only of collectives as a set of people. We can then form aggregate collective variates by combining information taken from each individual member. This important type of variate was seen in Table 2 where counties were classified by the median income of the inhabitants. Likewise, in The Academic Mind colleges were sometimes classified as conservative or progressive by using the average attitude score of the faculty members. These two examples used averages. Other measures such as ratios may be employed. Thus, Lipset (1956) classifies the locals of the printer's union according to the consensus of members about certain polotical issues a local is in disagreement if the members vote about 50-50 on an issue; a local with great consensus would be indicated, for example, by a 90-10 split.

Somewhat more complicated statistics may be appropriate. The dispersion of a distribution curve in each of a number of counties might permit us to classify them along the collective variate of economic homogeneity

or disparity. We have alluded to this possibility before and can now see its wider implications. We could have two variates for each member and then the collective variate could be the correlation between these two elements.

We have so far used a rather broad notion of collectives: classes of people with a common characteristic. A more strict definition of groups would require some mutual contact between members. Experiments with small groups provide examples, especially in the sense of Moreno's sociometry.[7] Assume that in a group of seven children each child is asked to choose two other children as partners in some activity. Now put the choices in the form of a matrix treating the children once as choosers and once as chosen.

Chooser \ Chosen	1	2	3	4	5	6	7
1		X	X				
2	X		X				
3	X	X					
4					X	X	
5			X				X
6	X			X			
7			X			X	

[7] The term "sociometry" is associated historically with the work of J. L. Moreno (1934). His sociometric method was characterized by the collection of data on the affective relationships among group members and subsequent description of the relational patterns in charts known as sociograms.

The first three children form a kind of clique where all members choose each other. The next four children do not select in this fashion. School classes with larger numbers of children could be classified according to the number of cliques they are divided into.

In addition to classes and groups of people, quantification has in recent years considered collectives which are structured by formal rules and division of labor. The idea of "organizational measurement" will be taken up later in this text.

In contrast to this aggregate type of collective variate, we find, in many studies, what one could call global collective variates. They are essentially based on the output of a collective which cannot be related anymore to its individual members; sometimes the term "emergent" characteristics is used. We can characterize the wealth of a city not by the average income of its inhabitants but by the amount of space we find devoted to non-productive activities (recreation, culture, etc.). The belligerency of a country can be indicated by the proportion of its budget devoted to "defense." Most of the elements we used to construct the quality score of colleges had this global character as long as one thought of a college as a collective of students.

McClelland (1961) has developed a score of "need for achievement" which can be applied to stories created by individual people as well as to stories traditionally told to children in a given society. Bradburn, one of McClelland's students, has even correlated need-achievement scores based on British popular literature with the output of coal mines over a few hundred years. This scoring of literature is clearly a global variate as compared to the aggregate variate when the score of individual respondents

is averaged, as McClelland did himself.

The formal nature of these global variates has in no way been fully explored. The most detailed review can be found in a paper by Coleman (1970). He also discusses the formal processes which are used, often implicitly, to make inference from the global indicators to underlying structural characteristics.

In recent years macrosociological studies have brought new attention to this type of quantification. Dahrendorf wrote a book trying to understand why democracy has always had such a weak hold on German society (1965). One of his arguments is that Germans put much more emphasis on their private rather than on their public role. When they are asked to describe their best quality they stress that they are good family men, which hardly happens with American respondents. For the German, being lonely is heroic; for the American, it is a sign of poor mental health. School as the guardian of "public values" and family as the matrix of "private values" have a very different weight in the institutional systems of the two countries. The forming of "macrosociological variates" of this type has been discussed in an unpublished Columbia dissertation by Helga Nowotny (1969). A summary of her work can be found in Lazarsfeld's report for UNESCO, Main Trends in Sociology. Just for the historical record, one should notice that these global indicators correspond closely to Durkheim's notion of a "social fact." A typical example is his distinction between systems of law which stress the punishment of the culprit vs. those which mainly require restitution of the damage he has done.

The distinction between aggregate and global collective variates is not always obvious, and classification depends on the substantive context.

The audience rating of a TV program is a collective variate in that it characterizes a collective preference -- it is ascertained by asking a random sample of people in the TV-viewing population whether they watched. The rating is a global collective variate because it is a rate and not a mere aggregation of individual preferences. Likewise, Durkheim's suicide rate is more than a simple aggregation of data on individuals; it is a global collective variate used to describe whole societies. The main point is to understand the use of rates as global variates in social research.

The following famous example is an appropriate ending of this part of our discussion. Stouffer had available paper and pencil tests by which he had gauged the "willingness for combat" among soldiers who were in training in a northwestern camp.[8] After the invasion of Normandy his staff had access to the same men. The question was whether the soldier's subseqent performance in combat was predictable from the scores established in the United States. The performance was established by field work where officers and non-coms were requested to categorize every soldier whom they had observed into one of three groups: average, below, or above. (The rating procedure is carefully described on pp. 54-58 of Stouffer, 1949). Taking just one element of the "willingness for combat" score, the relation to the combat rating was shown in Table 6.

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[8] The question read: If you were sent into actual fighting, after finishing one year of training, how do you think you would do?

TABLE 6

RELATION BETWEEN ATTITUDE TESTS TAKEN DURING TRAINING ON ACTUAL PERFORMANCE IN BATTLE

Answers to questions asked during training	Actual Combat Performance: Below Average	Average	Above Average
I think I would do all right.	23%	29%	31%
I think I would have trouble at first but after awhile I would do OK.	42	39	55
I haven't any idea how I would do.	17	20	9
I don't think I would do very well.	18	12	5
	100%	100%	100%
number of cases	(94)	(120)	(95)

The differences are clear but not very strong, and Stouffer decided to strengthen his result by a second approach. He shifted from individual soldiers to companies as the unit of investigation. The average test score was the aggregate collective variate by which "willingness for combat" was established for each company. But for battle performance Stouffer wanted to have a global variate; this would permit him to use a much larger number of cases, because the individual follow-up was expensive and difficult. He constructed the "non-battle casualty rate" -- an index based on the cases where soldiers had to be withdrawn because of nervous breakdowns, psychosomatic symptoms, excessive fatigue or other reasons not related to wounds or battle injuries. (The intellectual and administrative efforts

in developing this rate are described on pp. 6-10 of Stouffer, 1949). For a large number of companies Stouffer was able to establish these rates of non-battle casualties and relate them to the average score of combat willingness ascertained for the same group of soldiers when they were still in training. Table 7 gives the non-battle casualty rate during the invasion of Europe for nine rifle companies according to whether they had the very highest, very lowest or medium score before leaving the United States.

TABLE 7

TEST SCORE AND NON-BATTLE CASUALTY RATE (NCR)

Willingness for Combat Score	Average NCR
Very High	17.3
Medium	25.1
Very Low	28.2

The last two tables given equivalent results in two languages; one in terms of individual and the other in terms of collective variates.[9]

Organizational Variates

Organizations are collectives of special complexity. The number of functions their members perform are of great variety, their activity is largely regulated by explicit rules, and they usually work in various well-specified subdivisions related to each other by flows of communication and other services. Variates necessary to describe organizations are

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[9] It is not always true that the two approaches give the same result; but this is a topic which we shall not discuss in this section.

subject to all the distinctions we have made so far and require additional qualification. We shall review only a few of them.

From a formal point of view, an organization is segmentalized in at least two respects: it has hierarchies and it has divisions - either regional or functional. This alone gives rise to collective characteristics obtained by simple counts: number of supervisory levels; number of, say, departments; the mere number of employees which is often called the size of the organization is, of course, the outcome of a simple count. In each segment, people are working and this leads to secondary counts: the "span of control" tells how many people on the average work under the supervision of the next higher level; a "concentration index" tells whether people are or are not evenly distributed into the various segments. An organization also adds an important type of variate to what we have called direct individual characteristic : the type of work people are doing. This, in turn, permits the formation of new variates describing the complexity of an organization in terms of the number of job categories it contains; and it leads to aggregate collective variates, e.g., in a hospital, the proportion of employees who are not engaged in direct patient care. Ultimately, a combination of divisional and personal characteristics can engender more complex conceptualizations, including such global variates as the administrative ratio of an organization or a "discrimination index" based on the distribution of black employees among divisions.[10]

Hierarchical and divisional segmentalization with type of work added to the conventional individual variates account for a large amount of "organizational measurement." Let us analyze a number of characteristic

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[10] Under the title of "segregation indices" this variate has also been applied in community studies. For an instructive discussion, see Duncans' paper on this topic (1955).

tables so that the distinction made so far becomes more vivid; as we go along some additional ideas will be signalled.

Example 1. W. Evan (1962) shows that in an industrial research laboratory, people in the basic research division and in the development division are fairly satisfied because they do the work they are trained for (Table 8). This is not the case in the applied division which is a middle ground between basic experimentation and engineering. The finding comes from a simple two-variate relation which, however, has two unusual features. For one, discontent is inferred from behavioral items; and secondly, we deal here with a "salient scale" — four different indicators reinforcing each other in expressing a single concept. Note that "discontent" here is represented by a series of rates not attributed to individuals but the the three collectives.

TABLE 8

INDICATION OF MORALE IN THREE DEPARTMENTS OF A FACTORY (1958 means)

Indicator	Department		
	Basic	Applied	Development
Accidents	.06	.23	.14
Absence (days)	4.33	6.53	6.17
Late arrivals	14.44	19.68	15.03
Early departures	2.05	9.06	1.77
N =	18	31	35

Example 2. A much more complex case deals with the question of whether the "span of control" increases with the size of an organization.

Blau and Schoenherr (1971) studied this in 53 employment agencies and came to a rather suprising result which is expressed in Table 9.

TABLE 9

CORRELATION OF SIZE AND SPAN OF CONTROL

Level of Supervisor:	Division Head	Middle Manager	Front Line Supervisor
	.07	.22	.40

Notice first that the table covers three variates. Two are needed to form the correlation coefficients: the size of the agency and, the average number of employees working under one supervisor (span of control). A third variate serves as qualifier: the hierarchical level of the supervisor. The correlations between size and span of control clearly increase the lower the level. A division head has need for a limited number of staff services which seem to be the same, irrespective of the size of the organization. On the lowest level, work is probably rather homogeneous and the size of the unit under one supervisor more flexible; economic efficiency makes it understandable that it is larger, the larger the total organization. The correlation between size and span of control on the middle management level fits well into this whole picture.

Example 3. Here, too, we deal with three variates; two of them in themselves quite complex. Patricia Kendall (1963) studied 150 hospitals to describe the learning environments of different types. In one portion of the study residents were asked how friendly or competitive their relation with other residents is. A scale was developed based on questions reported

below.[11] It measured how cooperative the respondents felt toward each other (higher scores indicate greater cooperativeness).

TABLE 10

COOPERATIVENESS OF RESIDENTS ACCORDING TO "SHAPE" OF RESIDENCY PROGRAMS

Department	Pyramid	Semi-Pyramid	Parallelogram
Medicine	2.66 (387)	2.78 (202)	2.86 (160)
Obstetrics-Gynecology	2.36 (22)	2.50 (100)	2.55 (211)
Pediatrics	2.47 (108)	2.55 (49)	2.51 (83)
Surgery	2.03 (86)	2.44 (488)	2.57 (164)

(Figures in parenthesis are the number of residents in each configuration.)

At the same time, the table of organization in the various hospital divisions was classified according to the chances an intern had to be retained and promoted to higher levels of a residency. The author speaks of a "pyramid" structure if the organization chart provided fewer residents on each level of seniority. If many residents can be retained from year to year, she talks of a "parallelogram" structure.[12] The question is whether this formal structure is reflected in the attitude of the interns. As Table 10 shows, this is indeed the case for all but the third row. (The differences are all statistically significant.) The spirit of cooperation is higher the less threatening the objective situation, as can be seen from reading every row from left to right.

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11 The index of cooperativeness is based on the following questions answered by each resident: "How many of your colleagues are open and free about exchanging information?" "Are willing to help out when a fellow resident has a lot of work to do?" "Are trying to beat the other fellow out?" "Get along together socially?"

12 For a more detailed discussion of the variate "organizational shape" see the paper by Kaufman and Seidman (1970).

Kendall introduced a third variate as a qualifier. She studied the interns in different departments - clearly a divisional segmentation. Reading the figures of Table 16 along columns, we see what this variate adds to the hierarchical segmentation. Within each promotional "shape" the specialists in internal medicine are the most cooperative and the future surgeons the least cooperative - with two other specialists in between. A folklorist will not be surprised that surgeons have rather harsh attitudes. But in fact the regularity of the figures is remarkable and the whole result far from obvious.

Example 4. In Lipset's Union Democracy eighty local printing shops involved in the study were classified by size and by the political consensus of the members (over 63% of the shop vote for one party in the 1951 local election). In Table 11 we learn what proportion of members are active in union politics, within each type of local.

TABLE 11

SIZE OF PRINTING SHOPS AS A CONDITIONING FACTOR IN THE RELATIONSHIP OF CONSENSUS TO MEMBER ACTIVITY

	Percentage of members active in union politics	
	Shops with high political consensus	Shops with low political consensus
Shops with under 39 members	29% (125)	7% (28)
Shops with 30 or more members	43% (105)	43% (160)

The units of this table then are union locals. Comparing the first and the second row of percent figures, we find that in small shops there is altogether less political activity. But furthermore, the two shop sizes

differ as to the effect of consensus on the extent of this activity. In small shops with low political consensus there is hardly any overt political activity. There the members are afraid that a visible lack of agreement would endanger the cohesion of the local. Active politicking is not likely to be a menace to the occupational importance of the large union local because each member can join a subgroup of equal sentiment. In large locals, the level of political activity is high, irrespective of whether the local is homogeneous or not.[13]

Organizations provide two additional features for quantification: the activities of the members and the interrelations between them. Nothing new needs to be added to the general ideas presented in this paper; but many new combinations emerge. Sociometric ideas can be combined with the notion of hierarchical segmentalization to form variates implicated in more complex issues: to what extent is the rank and file represented on higher level committees? How far down have management people periodic contacts? The notion of "close supervision" can be quantified in two ways: we can use a questionnaire asking employees whether the organization leaves them opportunity for initiative, or we can count the number of rules which are codified in organizational documents. Supervisory style can be approached by asking supervisors what they think they are doing and asking their subordinates to describe their view of the same situation. Segmentalization also leads to new ideas on quantification. Alone, the problem of decentralization had led to a great deal of literature dealing with the flow of communication, the storage of information, etc.

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[13] The base figures in parentheses themselves form a two variate relation: smaller shops show high consensus more often.

The field of "organizational measurement" is developing very quickly -- no one has yet tried a comprehensive systematic classification and this in not the place to try it. If one is engaged in educational research, he would be especially interested in Barton's monograph (1961) on the study of college environments which is one of the earlier efforts of systematization. For more recent developments, The Administrative Science Quarterly should be consulted. In nearly every issue a new variate is proposed, applied, and discussed. For quick orientation, a collection of empirical studies edited by Heydebrand (1973) is especially useful. His material is organized along conceptual ideas and would deserve cross-analysis to see whether specific substantive problems require the use of specific types of variates. Some of this literature is not easy to follow. The reader is therefore urged to work through the additional findings from organizational studies discussed in our exercise book.

Variations on the Theme of Variates

1. In social science we almost always try to order the objects of our investigation along one or more intended or latent dimensions. The items we put together in an index are usually not important in themselves -- they are indicators of something else. It is like a doctor who doesn't have direct access to the lungs of his patient; he uses a variety of symptoms and tests to decide how great the probability is that his patient has T.B. If a psychologist wants to know whether people are anxious he asks them whether they have trouble sleeping, bite their nails, worry about extinguishing cigarettes, etc. The logic of such disposition concepts and their translation into classificatory instruments for individuals has been explored by many writers. It is important to realize that the same

logic applies to collective variates. The imagery behind the notion of college quality, for example, is the idea that it has a considerable capacity to provide excellent education. The investigator asks himself by what instruments this capacity is exercised and the choice of the items in the quality is made accordingly.

One more word about single indicators. Sometimes they can be extended into an index by using what one might call intensifiers. For example, certain ethnic or religious characteristics are strongly related with party vote. One always worries about whether there are spurious factors involved. So during a 1948 election study people were asked not only their ethnicity but whether it was important for them (Suchman and Menzel, 1955). All minorities had a tendency to vote for the Democratic Party, but when they were very Jewish or very Italian their propensity to vote this way was especially strong, as shown in Table 12.

TABLE 12

PERCENTAGE DEMOCRATIC OF TWO-PARTY VOTE

Catholics who:	
Chose religious group as "particularly important"	66% (129)
Did not choose it	58% (31)
Jews who:	
Chose the religious group as "particularly important"	72% (69)
Did not choose it	56% (39)
Negroes who:	
Think Whites are "not friendly" or "fairly friendly" to Negroes	84% (71)
Think Whites are "very friendly" to Negroes	61% (13)
Italian-Americans who:	
Have "quite a lot" of interest in what is going on in Italy today	90% (18)
Have "not very much" or "no" interest	79% (75)

The table does not explain the main finding, but it establishes it more firmly by demonstrating that the percent Democratic vote increases with degree of ethnicity. Simple ethnic identity was extended into an index of ethnic intensity using indicators of its importance. The result was a stronger demonstration of its relationship with other variates.

The use of single demographic terms as variates raises problems of specification. One finds that older people have more strict attitudes regarding sexual morality. What does age mean here? Having been brought up at a time of strict standards? Having become wiser as to the later consequences of early sex experiences? Having become insensitive to the importance of emotional experiences? For many cases the answer comes from techniques of interpretation which we shall discuss presently.

2. A typical use of multidimensional information is the "profile." A student who has taken three tests: one on verbal facility, one on utilization of symbols and one on visual dexterity, can rate differently on each of them. One might not want to rank the students but prefer to distinguish different types. Literature exists on how to reduce large numbers of such profiles into a small number of types and how to assign "mixed" cases to the nearest type. Inversely, intuitive typologies proposed by authors can be better understood by "substructing" the multidimensional classification from which they might have been derived -- often without the author being clearly aware of his reasoning. Profiles have been applied to collectives as well as to individuals. Much work has been done on describing the climate of a college: its traditions, its goals, its administrative practices, and so on. The categories in which such descriptions are made reflect the demands the college makes on its students.

At the same time there is an old tradition of personality measurements which describes the values, interests and working habits of students. Scholars have been interested in developing counseling techniques by matching the profile of the college with the profile of a candidate.

The relation between profiles and typologies has been discussed by Barton (1971). The more mathematical procedures to derive dimensions from all the interrelations between a set of items - factor analysis, multidimensional scaling, latent structure analysis - are not included in our discussion.

3. The choice of indicators is closely related to what is usually called the validity of a scale. Does it measure what the investigator wanted to measure? In this form the question cannot be answered. As the scale represents an intended classification, one would have to compare it with the intention of the investigator for which there is, of course, no direct measure. There are only indirect ways by which a scale can be tested in this sense, and this leads to the notion of construct validity. If, for instance, a new personality test is developed, one wants to be sure that this scale does not have a high correlation with other scales intended to measure a trait which goes under a different name. We also would want to see whether the scale leads to an expected result in a well examined field so that we can trust its use in unexplored areas. The literature on validity is very extensive; two characteristic references are Cronbach and Meehl (1955) and Campbell and Fiske (1959).

There seems to be a difference in the scaling tradition of various disciplines. Psychologists usually concentrate on a few scales and develop and extended tradition to standardize them. They look for the best ways to measure basic concepts like anxiety or aggressiveness. Sociologists are

much more willing to take chances on non-standarized instruments because they need so many scales and know that their content has to be changed often. Suppose we want to study whether a voter is more concerned with domestic affairs than with issues of foreign policy. Obviously, the indicators for two such scales have to change as the political scene changes.

The greater "carelessness" of the sociologist is related to the fact that his correlations are to begin with much lower than those a psychometrician is used to. It can be shown that this leads statistically to a rather useful and safe rule of thumb called the interchangeability of indices. In The Academic Mind the "eminence" of a social scientist was measured by two variates. One was a combination of elements consisting of the honors he received (prizes, election to professional office, etc). The other was based on the number or type of his publications. The two variates classified a social science professor in very different ways. Their interrelation is given in Table 13.

TABLE 13

INTERRELATION BETWEEN TWO INDICES OF EMINENCE

Productivity Score	Honors Score			
	4,3 (High)	2	0,1 (Low)	Total
4,3 (High)	789	261	64	1114
2	196	214	201	611
0,1 (Low)	20	134	535	689
Total	1005	609	800	2414

One could easily worry about which variate is "better." But when it comes to establishing an empirical proposition, it seems to make little difference which one is used. The problem was whether eminence leads to earlier promotion to full professorship. Obviously, age had to be considered because

it increases the probability of the top academic position. Tables 14 and 15 test the propositon, using two different variates for eminence, which are themselves not highly related.

TABLE 14

PERCENTAGES WHO ARE FULL PROFESSORS ACCORDING TO AGE AND EMINENCE (PRODUCTIVITY INDEX)

Eminence in Terms of Productivity Score	Age		
	Under 40	41-50	51 or More
4,3 (High)	15% (324)	63% (358)	87% (421)
2	7% (349)	39% (131)	65% (122)
0,1 (Low)	2% (439)	23% (126)	45% (108)

TABLE 15

TABLE 14 REPEATED USING THE HONORS INDEX OF EMINENCE

Eminence in Terms of Honors Score	Age		
	Under 40	41-50	51 or More
4,3 (High)	18% (312)	65% (308)	88% (368)
2	6% (298)	28% (149)	73% (148)
0,1 (Low)	2% (488)	22% (150)	44% (132)

The two tables provide practically the same result. Eminence, however measured, is conducive to promotion and so, incidentally, is age. (The critic of academic life might compare the first line and the last columns: sitting it out seems more successful than effort.)

Closely related to the problem of validity is another decision which an investigator may have to make at his own risk. Take again the example of college quality. Should one include in the scale the test scores obtained by seniors who take the graduate entrance examination? From one

point of view the answer is negative. One would be inclined to construe college quality in such a way that one can obtain as a substantive result the relation between the quality of the college and the performance of the students. For other purposes one might want to include the students' test scores in the description of the college, for instance, if one wants to compare private and public institutions. Such a decision is not always easy and can affect the validity of the index. A famous example of this is provided by the "authoritarian personality." The F-scale (Adorno, 1950) somehow measures people's "meanness." The score is highly related to anti-Semitism. When would one make ethnic or religious discrimination part of an enlarged F-scale? These are substantive decisions which have to be left to the intuition of the investigator.

4. Judgment may also be necessary in the construction of indices. The measurement of effect exemplifies confounding issues. Suppose a political party offers a prize for the district leader who shows the biggest improvement in voting record. Two leaders compete for the prize, one who increased his party's vote from 70% to 80% and the other who increased it from 20% to 30%. The first one says his 10% is remarkable because he had only 30% of the original voters among whom he could make converts. So his improvement is one-third (10%/30%) while the other man had only an improvement of one-eighth (10%/80%). "No," says his competitor. The earlier vote in his district was a sign that it was hard to make any inroad into the other party's strength; the fact that he increased the vote by one-half while his competitor increased it only by one-seventh should give him the prize. At issue is the appropriate baseline for measuring effect.

Hovland (1949) gives an interesting example pertinent to evaluating the effect of educational material. During World War II, a group of American soldiers were shown a film "The Battle of Britain," which contained some information on the British Navy. After the showing this group and a matched group not exposed to the film were asked one information question.[14] The two samples were divided into four groups according to their educational backgrounds. Table 16 shows in the first two lines the proportion of respondents who gave the correct answer. The last two lines give the "effect" established by the two ways just discussed.

TABLE 16

PERCENTAGE ANSWERING CORRECTLY ON ITEM EXPLAINED IN A FILM

	Grade School Men	Some High School	High School Grad.	College Men
A) Exposed Group: A =	32%	57%	60%	78%
B) Control Group: B =	31%	29%	38%	55%
Effect 1: $E_1 = \frac{A-B}{B}$ =	.03	.97	.58	.42
Effect 2: $E_2 = \frac{A-B}{1-B}$	.01	.39	.35	.51

The educated soldiers are, to begin with, better informed. But Effect 1 seems to indicate that soldiers with some high school education learn most from the film (E_1 = .97). Hovland rejects this conclusion in favor of Effect 2

[14] The soldiers were asked whether they believed that the British Navy could not operate in the Channel because of the danger of air attacks.

which indicates that college educated people also learn most (E_2 = .51). He feels that E_1 is affected by a "ceiling effect," the college people have little chance of improvement as a group because such a large proportion is already informed.[15]

The difference between the measures may be stated in another way: E_1 measures improvement relative to the percentage who already know the correct answer, while E_2 measures improvement relative to the percentage who do not know the answer. Thus E_1 is a percentage increase in the knowledgeable proportion of the sample, while E_2 is a percentage decrease in the uninformed sector. Both cases must be interpreted with consideration for initial levels.

5. We have discussed, above, the most elementary ways to combine elements into variates. More complicated questions can be raised. Is it possible, on statistical grounds, to exclude items because they "don't belong" in the scale? Do we need mathematical models like factor analysis or latent structure analysis to combine items? This is not the proper place to go into these. I only want to comment on the question of whether it is sometimes justified not to combine elements at all? Almond and Verba (1965) used the Rosenberg "Faith in People" questions to compare a number of countries. Each country was characterized by the proportion of people in a public opinion poll who gave positive replies to each individual question --- an aggregate multidimensional collective variate. Clearly, an average of the six step scale for each country would have been

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15 An additional shortcoming of E_1 is that it cannot be applied to cases where everyone is initially uninformed -- one cannot divide by 0.

quite unrevealing. On the other hand, for individual respondents, a separate listing of five answers would not have been as useful as an index, such as used in Table 3. The reader is invited to sketch a profile for each country in Table 17. Obviously, the United States and Germany come out very differently; Mexico's profile is a strange mixture, which may be characteristic for a peasant society.

TABLE 17

SOCIAL TRUST AND DISTRUCT, BY NATION

Percentage Who Agree That	U.S.	U.K.	Germany	Italy	Mexico
Statements of Distrust:					
"No one is going to care much what happens to you, when you get right right down to it."	38	45	72	61	78
"If you don't watch yourself, people will take advantage of you."	68	75	81	73	94
Statements of Trust:					
"Most people can be trusted."	55	49	19	7	30
"Most people are more inclined to help others than to think of themselves first."	31	28	15	5	15
"Human nature is fundamentally cooperative."	80	84	58	55	82
Total Number of Respondents	(970)	(963)	(955)	(995)	(1,007)

One might call this the use of "silent scales:" the separate reporting of items with the implication that the reader has all the information necessary to visualize the result if the items were combined. Lipset, in chapter 2 of his book, Political Man, compares a large number of countries according to whether they have or do not have a democratic political system. His thesis is that the probability of such a system is greater if a country is wealthy, has a high level of education, is industrially developed, etc. He records a score of such items and invariably finds that on each of them the democratic countries fare better than the undemocratic ones. Obviously for his main thesis this is a very persuasive procedure. It might have its shortcomings if Lipset had introduced additional "outside" variates of the kind which have been asked in other studies: Is a stable democracy compatible with frequent changes of government? Is it compatible with an authoritarian form of schools or factory management? He might then have needed some index of prosperity to use as a specifying variate in a more complex type of multivariate analysis.

Type of Multivariate Propositions:

Every table reported so far implied some factual proposition stating the interrelation between variates. To see the "grammar" involved in this kind of language, a number of distinctions are helpful.

We begin with a finding from the study of hospital interns mentioned before. Experts classified colleges, medical schools and hospitals into high and low categories according to their quality. Tabulations for 2,629 respondents showed that attendence at a superior institution increased the chances of acceptance at a superior place at the next educational level.

The cross-tabulation for undergraduate college quality and medical school attended is shown in Table 18a. The difference in the chance for attending a good medical school is 20% in favor of students from a high quality college. The relationship between medical school quality and hospital of internship is given in Table 18b. The difference in the chance for a

TABLE 18a

QUALITY OF COLLEGE RELATED TO QUALITY OF MEDICAL SCHOOL

		College Quality	
		High	Low
Medical School Quality	High	56%	36%
	Low	44%	64%
		1061	1568

TABLE 18b

QUALITY OF MEDICAL SCHOOL RELATED TO QUALITY OF HOSPITAL OF INTERNSHIP

		Medical School Quality	
		High	Low
Hospital Quality	High	66%	43%
	Low	34%	57%
		1168	1461

good internship is 23% in favor of students from a superior medical school. But the effect over two steps -- from college to hospital -- is much smaller, as can be seen in Table 18c.

TABLE 18c

QUALITY OF COLLEGE RELATED TO QUALITY OF HOSPITAL OF INTERNSHIP

		College Quality	
		High	Low
Hospital Quality	High	56%	51%
	Low	44%	49%
		1061	1568

It is apparent that the effect of college quality on eventual placement in a high quality hospital is indirect: college quality has an effect on

acceptance at a superior medical school which, in turn, has an effect on acceptance as an intern at a superior hospital. But the direct effect -- college quality on hospital quality -- is small. However, it can be demonstrated with greater formality that even the apparent direct effect of college quality is simply a reflection of its indirect influence: if one controls for medical school quality, the relationship between college quality and hospital internship quality virtually disappears, as demonstrated in Table 18d.

TABLE 18d

THE RELATIONSHIP BETWEEN COLLEGE QUALITY AND HOSPITAL QUALITY CONTROLLING FOR MEDICAL SCHOOL QUALITY

		Medical School Quality: High		Medical School Quality: Low	
		College Quality: High	College Quality: Low	College Quality: High	College Quality: Low
Hospital Quality	High	67%	65%	42%	44%
	Low	33%	35%	58%	56%
		596	572	465	996

We experience the role of the medical school as an interpretation of the college-internship relation because it is clearly "intervening," it comes in time between college and internship. If medical school were antecedent to college we would rather talk of an explanation and test for a spurious[16] relation.

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16 A relationship can be demonstrated to be spurious if when the effects of one or more antecedent variates (related to the principal variates) are controlled, the relationship becomes negligible. Thus the initial observed effect is shown to have been produced by antecedent variates.

Concern over the temporal position of a qualifying variate is essential to making causal inferences, as shown in the following example where qualifying variates assume either of two positions. It is found that in densely populated areas the crime rate is higher than in sparsely populated areas. Some authors state that this could not be considered a true causal relationship; but such a remark if often used in two very different ways. It could suggest an intervening variable: for instance, the increased irritation which is the result of crowded conditions. This does not detract from the causal character of the original relationship. On the other hand, the argument might go this way: low-rent areas attract poor people who cannot afford spacious housing, and whose poverty syndrome is associated with higher criminality than in other populations. Here the character of the inhabitants is antecedent to the crowding. In this case the original relationship is indeed explained as a spurious one and should not be viewed as a causal chain.

Probably the most fruitful mode of analysis are the so-called specifications. During World War II, absenteeism in the factories was a national concern. One large-scale study showed 56% of all male workers and 63% of all female workers had been absent at least once during a recent period of observation (Katz and Hyman, 1947). Was this a sign that women take their work less seriously? A more convincing explanation came from a cross-tabulation reported in Table 19.

TABLE 19

PERCENTAGE ABSENTEES AMONG 4 GROUPS OF WORKERS

Married		Unmarried	
Male	Female	Male	Female
51%	69%	57%	57%

The original sex difference is now reduced to the left side of Table 19. Only among married workers are women more absent than men - and there the difference is considerably greater (69% - 51% = 18%) than the one with which we started (63% - 56% = 7%). Inversely, there is no sex difference in the absentee rate of unmarried workers. In view of the traditional family responsibilities of married women the interpretation will now be quite obvious. In a formal way the variate "marital status" has been used as the qualifier of the original result. (The reader is invited to single out the nature and role of qualifiers in examples 1 and 4 of the preceding section on organizational analysis.)

Two versions of specified propositions are noteworthy. Sometimes we are investigating the relation between two individual characteristics. If this relation is different from one context to another, we can talk of contextual proposition. A good example comes from a very interesting paper by David Nasatir (1972) who studied academic failure of students living in Berkeley dormitories. He divided his students into academic and non-academic types, according to whether they thought of college as a way to obtain a basic general education or as the road to vocational advancement. For both types he figured the failure rate as the proportion of students who dropped out before graduation. As would be expected, the failure rate for the academic type was lower (10%) than for the non-academic (20%). He then introduced a characteristic of the dormitories as a collective variate of the aggregative kind. The academic dormitories were those with a majority of academic students; the non-academic dormitories were the others. The finding due to this refinement of the analysis was as follows: in non-academic settings the failure rate of the two types of students was

about the same. The difference between academic and non-academic individuals was concentrated and very large indeed in the academic residences.

TABLE 20

FAILURE RATE BY TYPE OF RESIDENCE
FOR TYPES OF INDIVIDUALS

Type of Individuals	Type of Residence	
	Academic	Non-Academic
Academic	7% (42)	12% (42)
Non-Academic	26% (120)	14% (106)

To put it in somewhat sharpened terminology, the relation between motivation and success is very small in one environment and very strong in another. (A further interesting specification might refer to the road by which the two types of students were distributed to the two types of dormitories. No data seem to have been available on this point.)

Contextual propositions then show how a collective variate affects the relation between two individual variates. As such, they are especially close to the interest of the sociologist who wants to know how psychological patterns are affected by a social structure. But the general mode of specifying propositions is also closely related to a psychological tradition. The literature on tests often discusses notions like moderator and suppressor variables. In the frame of the present discussion these are all qualifiers which affect an originally undifferentiated prediction. Ann Pasanella has discussed this matter in a comparative analysis of "Stratifying Devices" (1972).

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INTRODUCTORY EXERCISES --David A. Ford

Exercise Set 1

The purpose of this exercise set is to make certain that you understand basic skills needed to work with tables. If you have any experience at all with reading or constructing percentage tables you might want to skim part A and proceed to part B where you can check your skills.

Part A

Table 1 is intended to show the relationship between political involvement and identification with a labor union for 428 individuals. What does it tell us? Is there a relationship between the variates? First, to facilitate our understanding of the table, we should determine intuitively what we expect to find. For example, one might hypothesize a relationship of the form "the greater the union identification, the higher the political involvement." That is, if we select an individual from the sample who identifies with the union to a great extent, we would also expect him to have a relatively high political involvement. Conversely, if the person selected does not identify strongly with the union, we would expect him to have low political involvement.

In terms of the aggregate of individuals, we expect the percentage exhibiting high political involvement to be greater for those with high identification than for those with low identification. Such is the case in Table 1.

Suppose our hypothesis stated a reversed dependence structure: "The higher the political involvement, the greater the union identification." Let us see if Key's data substantiate that hypothesis.

1) According to our discussion above, we should expect a greater/lesser percentage of individuals with high involvement to have high union identification. Is this true for Key's data? We cannot answer the question with the present form of the table because it is not percentaged by political involvement. That is, the figures in the rows rather than the columns should add to 100%.

We can retabulate and percentage the data under the following steps:

1. convert all table entries to raw figures.

2. sum the raw data across each row to get the total number of persons with each category of involvement.

3. compute percentages by political involvement.

Let's try it.

1. The number of persons with high involvement and least identification is found by taking 17% of the total who are least identified:

$$83 \times .17 = 14$$

2) Thus ____ persons have high involvement and least identification. The number of persons with political involvement level 3 and least identification is 19% of 83 or ____. Similarly, the number of members with identification level 2 and high involvement is 14% of 126, or ___ .

2. The row totals are found by simply adding up the number in each row.

3) Complete the remainder of the table below:

Table 1.1 Sense of Union Identification in Relation to Level of Political Involvement

			Union Identification: Least Identified 1	2	3	Most Identified 4	Total
Political Involvement	High	4	14	18	29	38	99
		3	16	36	26		
		2	30	42			
	Low	1	23				
	Total		83	126	109	110	428

You can check your work by first making certain that the figures in the columns sum to the correct totals, and then by making certain that both the column totals and the row totals add to 428.

Note: If you happened to check the figures already given, you discovered that they were "doctored" to insure that they sum to the proper totals. Converting to raw figures from percentages often produces fractions which must be rounded to whole numbers (we can't have 3.33 people!). This typically results in slight errors, but in this exercise it need not be of great concern to you, because we have insured that your rounded results will be correct. But in the absence of further checks on the data, you should recognize that your answers are approxi-

mations which may not be perfectly consistent with the original data.

3. Finally, to determine the relationship of union identification by political involvement, you must compute the percentages across the rows.

4) Fill in the following percentage table:

Table 1.2 Level of Political Involvement in Relation to Sense of Union Identification

		Union Identification					
			Least Identified			Most Identified	
			1	2	3	4	Total
Political Involvement	High	4	14%	18	30	38	99
		3	16%	35	25		103
		2	23%	31			134
	Low	1	25%				92

Check your work by making certain that the rows sum to 100%. (See Note above concerning rounding error).

It is customary to present tables in such a way that the column totals are the bases for percentaging. Accordingly, your new table might be inverted and displayed as follows:

Table 1.2 Level of Political Involvement in Relation to Sense of Union Identification

			Political Involvement			
			High			Low
			4	3	2	1
Union Identification	Least Identified	1	14%	16%	23%	25%
		2	18	35	31	33
		3	30	25	21	28
	Most Identified	4	38	24	25	14
			100%	100%	100%	100%
		N	99	103	134	92

We can now return to our primary concern: is it true that the higher the level of political involvement, the greater the sense of union identification? Apparently "yes", although the relationship is not very strong. Reading across the bottom row from High Involvement to Low Involvement, we see that the percentages of those who identified most decrease, although there is essentially no difference between involvement levels 3 and 4 in the Most Identified category. Conversely, looking at the top row, as involvement decreases, the percentages with the least identification increase.

Notice that, for the most part, the differences are clearest and most consistent between the highest and lowest categories of both variates. The middle categories are not especially sensitive indicators for demonstrating the expected relationships.

Key might have simplified the table while simultaneously highlighting the relationships by collapsing the variates into simple "high" and "low" (or "least" and "most") categories. Thus, for each variate, persons with levels 1 or 2 would be combined into a single "low" category, and those with levels 3 or 4 would constitute a single "high" category. Under this collapsing procedure, we would have 209 persons classified as having low union identification and 210 as having identification.

5) Similarly, there would be 226 persons with low political involvement and _____ with high involvement.

6) Cross-classifying these simplified variates yields a fourfold table. Fill in the following table using the raw figures you computed for Table 1.

Table 1.3

Union Identification

		Low	High	Total
Political Involvement	High	84		
	Low	___	___	226
	Total	209	219	428

7) Determine the relationship between union identification and political involvement by computing the percentages for the following two tables:

Political Involvement	High	%	%
	Low		
		100%	100%
	N	209	219

Union Identification		High	Low
	Low	%	%
	High		
		100%	100%
	N	202	226

You can see from these two tables that the relationships hypothesized are symmetrical, i.e., political involvement tends to increase with high union identification and union identification tends to increase with high political involvement. You should realize that it is not necessarily true that variates related in one direction will be related inversely. A case in point is presented subsequently.

The terms 'independent' and 'dependent' will be used henceforth to describe variates in relation to one another. An independent variate is assumed to cause or in some other way influence the values of another variate - the dependent variate. In a hypothesis of the form "the greater X, the greater Y," X is the independent variate and Y is the dependent variate. If you encounter a percentage table demonstrating a relationship, you can expect the percentages to be

computed by categories of the independent variate; if the table follows the convention of percentaging down columns, you will find that categories of the independent variate form the columns while those of the dependent variate form the rows.

In Table 1 Union Identification is the independent variate and Political Involvement is dependent. The exercise you just completed reversed that assignment, assuming instead that Political Involvement is independent. Exercises later in this book will ask you to describe the dependence structure of a given table. You may do so using this terminology.

Part B

Generally a table contains much more information than was principally intended. We have just seen how the data from one table can be computed to yield another table describing a different relationship between the variates. What additional information of general interest can be derived? What other questions might be answered by the data in a table?

Two rather simple questions are often of interest (and probably would have been answered by the researcher in the process of constructing a table such as Table 1). The first concerns the simple percentage distributions of individuals under the categories of each separate variate; the second concerns the overall percentage distribution of the combined variates.

What percentage of Key's respondents identified least (level 1) with a union? Table 1 already provides the necessary data to determine this. We see at the bottom of the first column that 83 persons are classified as "least identified." Also, we know that we are dealing with a total of 428 individuals (this can be verified by adding the column totals). Thus, we can find the proportion of those 428 individuals who identify least by dividing 83 by 428 (83/428 = .19). Multiplying by 100 gives us the percentage who identify least, i.e., 19%. Following this procedure for each category of the variate we can compute a percentage distribution for union identification, displayed as follows:

Union Identification

		N	%
Least Identified	1	83	19.4
	2	126	29.4
	3	109	25.5
Most Identified	4	110	25.7
		428	

1) We can construct a percentage distribution for political involvement in the same way using the raw data you entered in Table 1.1. Fill in the missing information:

Political Involvement

		N	%
High	4		
	3		
	2		
	1		
		428	

Sometimes you may want to know the percentages of the total units within contingent categories of the variates. You might ask, "what percentage of persons had both the least union identification and the highest political involvement?" Table 1.1 again provides data for answering the question.

2) The upper left hand entry in the table shows that ____ persons satisfy the specifications.

3) Dividing _____ by 428 and multiplying by 100 results in _____, the percentage with both the least identification and high involvement.

Part C

To give you more practice in working with tables of the sort just described, the next set of exercises will be based on a table which we have not discussed before.

The relationship between performance variates and social-psychological variates is an important concern of education researchers. Morris Rosenberg and Roberta Simmons have examined the relationship between grades and self-esteem for a sample of children from grades 3-12 in twenty-six Baltimore schools. Table 1.4 shows data for secondary school children.

Table 1.4

Self-Esteem of Secondary School Children by Marks in School

	Marks in School			
Self-Esteem	A	B	C	D
High	71%	43%	39%	39%
Medium	12	32	35	22
Low	17	25	26	39
N	(24)	(279)	(387)	(87)

1) What are the units of Table 1.4?

a) individuals
b) collectives (non-organized aggregates)
c) collectives (organized groups)

2) How many points in time are represented by the data in the table?

3) What is the nature of the numbers displayed in the table?

a) raw data (frequencies)
b) percentages
c) scale scores
d) averages (means)

4) How many variates make up the table?

5) Which (if any) variate in Table 1.4 is an independent variate?

6) Which (if any) variate in Table 1.4 is a dependent variate?

7) Table 1.4 supports the proposition that:

a) the lower a pupil's marks in school the higher his self-esteem
b) the lower a pupil's self-esteem, the higher his marks in school
c) the higher a pupil's marks in school, the higher his self-esteem
d) the higher a pupil's self-esteem, the higher his marks in school
e) the variates are unrelated

8) Complete the following table of frequencies using the data from Table 1.4:

Table 1.5

Self-esteem of Secondary School Children by Marks in School (frequencies)

	Marks in School			
Self-esteem	A	B	C	D
High	17	120		34
Medium	3			19
Low	__	70	101	__
N	(24)	( )	(387)	(87)

9) What percentage of the secondary school children had B marks in school?

10) What percentage of the secondary school children had low self-esteem?

Now consider the possibility that the relationship between marks and self-esteem is symmetrical; i.e., that self-esteem influences school achievement. Table 1.6 is set up to test for this possibility.

11) Fill in the missing information in Table 1.6.

Table 1.6

Marks of Secondary School Children by Self-Esteem

Marks in School	Self-Esteem High	Medium	Low
A	5%	%	%
B	37	36	
C			48
D	—	8	16
N	(322)	( )	( )

12) Table 1.6 shows that

a) the higher a pupil's marks in school, the higher his self-esteem
b) the higher a pupil's self-esteem, the higher his marks in school
c) the lower a pupil's marks in school, the higher his self-esteem
d) the lower a pupil's self-esteem, the higher his marks in school
e) marks in school are unaffected by self-esteem

It is always possible that the relationship (or lack of a relationship) between two variates may be influenced by other variates. Exercise Set 2 deals with multivariate tables displaying such influences.

Exercise Set 2

Part A

Let us now examine Table 2, a quantitative display of findings from Sill's study on contributions to the March of Dimes. As was demonstrated in the text Sill's table differs from Key's table in most of the aspects of quantification discussed. For now we shall concentrate on one of these - the number of variates, or the dimensionality, of the table.

Table 2 deals with three variates: 1) median family income of a county, 2) polio incidence rate of a county, and 3) the per capita contributions (proceeds) for a county March of Dimes. The table is actually abstracted from a more obvious three-dimensional table. Let's try reconstructing that table (to the extent possible with the data on hand).

First, what data is missing that can be inferred from the table? We see that only the percent raising over 34 cents per capita is given. The percent raising 34 cents or less is not displayed. If you want to show both high and low contributions, you might construct a table with the structure of Table 2.1

1) Fill in Table 2.1

Table 2.1 Per Capita March of Dimes Proceeds in Counties Served by Foundation Chapters

	Median Income of County								
	High			Medium			Low		
	Polio Incidence Rate of County								
Per Capita Proceeds	High	Medium	Low	High	Medium	Low	High	Medium	Low
High (Above 34¢)	75%	57%	%	%	%	%	%	%	%
Low (34¢ or less)	25								
	100%	100%	100%	100%	100%	100%	100%	100%	100%
N	253	384							

Tables 2 and 2.1 illustrate two different ways of presenting the same data. The choice between them is often a matter of style, although not necessarily arbitrary. Table 2.1 presents at a glance much more data than Table 2, even though the data were derived from the simpler table. But in a sense, the extra information is redundant since any relationship observed among the percentages of high contributions will obtain for the low contributions. This is true in general when there are only two categories within a variate. Since such is the case here, Table 2 is more parsimonious.

Actually, Sills presented his data in an even larger table as reproduced in Table 2.2.

Table 2.2 1953 Per Capita March of Dimes Proceeds in Counties Served by Foundation Chapters

	MEDIAN FAMILY INCOME OF COUNTY								
	High			Medium			Low		
	POLIO INCIDENCE RATE OF COUNTY*								
1953 per capita proceeds	High	Medium	Low	High	Medium	Low	High	Medium	Low
$.47 and over	48%	27%	18%	39%	13%	8%	13%	1%	1%
.35-.46	27	30	36	25	22	17	16	3	2
.26-.34	16	30	22	18	28	19	18	12	10
.25 and less	9	13	24	18	37	56	53	84	87
	100%	100%	100%	100%	100%	100%	100%	100%	100%
N	(253)	(384)	(83)	(484)	(793)	(298)	(54)	(406)	(318)

*1950-1952 weighted average.

2) Verify for yourself that Table 2 is derived from Table 2.2

The exercises which follow deal with relationships among the variables of Table 2. You might find the data easier to work with when it is displayed as in Table 2.1.

3) In preparation for subsequent exercises, reconstruct a table of raw figures from Table 2.1 by filling in Table 2.3.

Table 2.3 Per Capita March of Dimes Proceeds in Counties Served by Foundation Chapters (in raw figures)

	MEDIAN FAMILY INCOME OF COUNTY								
	High			POLIO INCIDENCE RATE OF COUNTY*			Low		
Per Capita Proceeds	High	Medium	Low	High	Medium	Low	High	Medium	Low
High (above 34¢)	190	219	45	278	75	16	16	9	
Low (34¢ or less)	63			515	223	38	390	309	
TOTAL	253	384			298	54	406	318	

Using the raw data of Table 2.3 we can reconstruct those parts of Sill's thinking, through tables, which led to the final display of Table 2.

As discussed in the text, Sills expected per capita contributions of a county to be related to the median family income. Verify that there was a relationship in the absence of the polio incidence variate. What is the relationship between the median family income of the counties and the per capita March of Dimes proceeds? We can determine this by constructing a table with the structure of Table 2.4. The table can be filled in using data extracted from Table 2.1. It will first be necessary to determine the appropriate raw data for each entry and then to percentage by family income.

4) Fill in the following table with the correct raw data:

Table 2.4

	Median Family Income of County		
Per Capita proceeds	High	Medium	Low
above 34¢	454	663	
34¢ or less	266		
N	720	1575	

Check your work by making certain that you have entered the correct column totals obtained from Table 2 or Table 2.1. Then see that your raw figures sum to those column totals. (Be alert to possible rounding errors.)

5) Now complete the percentage table from the raw data in order to show

Table 2.5 Median Family Income of County

Per Capita Proceeds	High	Median	Low
over 34¢	63%	%	%
34¢ or less	37	58	
	100%	100%	100%
N	720	1575	

6) Are county per capita proceeds related to median family income?

It was not immediately obvious to Sills that the incidence of polio, unlike family income, would be related to contributions. He had already found only a week relationship between the polio incidence of a county and the percentage of March of Dimes contributors in its population. On the other hand, if the incidence of polio were related to median family income, one would expect polio incidence to be related to contributions, if only spuriously. Do Sills" data show a relationship between family income and incidence?

7) Using the procedures of the previous exercise, complete the following percentage table. [Note: the raw data for this table are taken directly from the figures in parentheses in Table 2.]

Table 2.6

	Median Family Income of County		
	High	Median	Low
Polio Incidence in county			
High	35%	31%	%
Medium	53	50	52
Low	12		
	100%	100%	100%
N	720	1575	778

Quite clearly, there is a moderate relationship shown in Table 2.6. Then what about the relationship between polio incidence and contributions?

8) Complete Table 2.7.

Table 2.7 Polio Incidence Rate

Per Capita contributions	High	Medium	Low
Over 34¢	65%	32%	%
34¢ or less	35		
	100%	100%	100%
N	791	1583	699

Having discovered these relationships, what reasons could Sills have had for constructing a table such as Table 2.2? One obvious reason is that it presents a considerable amount of data in a very simple form--just look at all the tables you were able to produce from it. But perhaps more important, it shows that the relationship between the incidence of polio and per capita contributions holds despite the influence of family income on contributions.

This type of procedure for analyzing relationships among variates is essential for understanding causal structure. You will have other opportunities for this type of analysis later.

Part B

The following set of exercises is intended to give you more practice with identifying aspects of quantification and with representing relationships among multiple variates. The exercises should also serve to introduce you to methods of multivariate analysis.

David Nasatir has studied selected influences on students' success or failure in college. His work is of particular interest for its use of variates relating individuals to the social contexts in which they function--an approach known as contextual analysis.

Nasatir examined data on 310 male dormitory students from the entering class of 1959 at Berkeley. His principal variates were i) the academic status of each student (having passed or failed), ii) a classification of residences into academic or non-academic types, iii) a similar classification of the students, and iv) the degree to which a student was integrated into the social context of his dormitory. Data were obtained from records on student residences and from questionnaires administered to the subjects. A student was classified as having failed if, after two academic years in residence, he had been dismissed because of academic failure. He was further classified according to his academic (or non-academic) orientation, indicated by expressed "agreement with a statement that the most important reason for attending college is to obtain a basic general education and appreciation of ideas." The same indicator served as a basis for labeling residences. A dormitory was "academic" if the proportion of its residents agreeing with the education statement was greater than the mean of such proportions for all dormitories.

Nasatir's initial findings on the effects of individual type and residence type on failure are presented in Table 2.8. Examine the table closely. The questions that follow deal with both the overall relationship and the more detailed pairwise relationships between the variates.

Table 2.8 Failure Rate by Type of Residence for Types of Individuals

Type of Individual	Type of Residence	
	Academic	Non-academic
Academic (percent)	7	12
Bases of percentages	(42)	(42)
Non-academic	26	14
Bases of percentages	(120)	(106)

1) What are the units of Table 2.8?

   a) individuals
   b) collectives (non-organized aggregates)
   c) collectives (organized groups)

2) How many points in time are represented by the data in the table?

3) What is the nature of the numbers displayed in the table?

   a) raw data (frequencies)
   b) percentages
   c) scale scores
   d) averages (means)

4) How many variates make up the table?

5) Which (if any) variates in Table 2.8 are independent variates?

6) Which (if any) variates in Table 2.8 are dependent variates?

7) Which one of the following propositions is not supported by Table 2.8:

   a) Academic student types in non-academic residences are more likely to pass than are non-academic students in academic residences.
   b) Academic students in academic residences are less likely to fail than are academic students in non-academic residences.

c) Non-academic students in non-academic residences are more likely to fail than are non-academic students in academic residences.
d) Differences in the failure rates of academic and non-academic students in non-academic residences are negligible.

The following questions concern qualified relationships among the variates. You will probably find it necessary to reconstruct simple bivariate tables to help you interpret the data.

Indicate whether each of the following propositions is true or false:

8) A greater proportion of students in academic residences failed than did students in non-academic residences.

9) A greater proportion of academic students failed than did non-academic students.

10) The greatest proportion of failures were non-academic students in non-academic residences.

11) A greater number of students in non-academic residences failed than did students in academic residences.

12) The greatest number of students who passed were academic types in academic residences.

13) Most of the academic students lived in non-academic residences.

As you have just seen, several of Nasatir's findings are quite surprising. Principal among these was that the proportion of non-academic students who failed was greater for those in academic residences than for those in non-academic residences. However, you discovered that, in general, the failure rate was higher in academic residences. Since this was not true for academic students, there is clearly interaction between student type and residence in determining failure. What else might contribute to explaining the discrepancies?

Nasatir proposed that while residence itself is important, it is especially important to know the extent to which a resident is integrated into the life

of the dormitory. Accordingly, he measured a student's integration using the proportion of time the student spent in the company of others in his residence. Relating degree of integration to both failure rate and failure by type of individual, Nasatir found that non-integrated students were more likely to fail, but that this relationship was reversed for academic types.

What then was the effect of integration on the three-variate relationship of Table 2.8? Table 2.9 provides the evidence.

Table 2.9 Failure Rate by Type of Individual Degree of Integration and Context

TYPE OF INDIVIDUAL	INTEGRATED INDIVIDUALS		NON-INTEGRATED INDIVIDUALS	
	Academic Context	Non-academic Context	Academic Context	Non-academic Context
Academic (per cent)	0	19	11	29
Bases of percentages	(14)	(16)	(28)	(26)
Non-academic (per cent)	16	7	30	17
Bases of percentages	(38)	(29)	(82)	(77)

Are the following statements, according to the evidence presented in Table 2.9, true or false?

14) In an academic context, a greater proportion of non-integrated academic students passed than did integrated academic students.

15) When degree of integration is controlled, academic students in non-academic residences are more likely to pass than are non-academic students in academic residences.

16) In a non-academic context, the differences in the failure rates of academic and non-academic students are negligible when degree of integration is controlled.

17) The failure rate of non-integrated students is higher than that of integrated students.

18) The failure rate of academic students is higher among those who are integrated than among those who are not integrated.

Perhaps the most interesting point made evident by Table 2.9 is that, controlling for degree of integration, the failure rate is apparently a function of the inconsistencies between types of individuals and their social contexts.

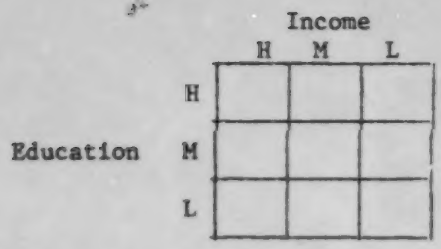
19) Try to clarify this finding by stating it in your own words and indicating how it is supported by Table 2.9.

INDICES

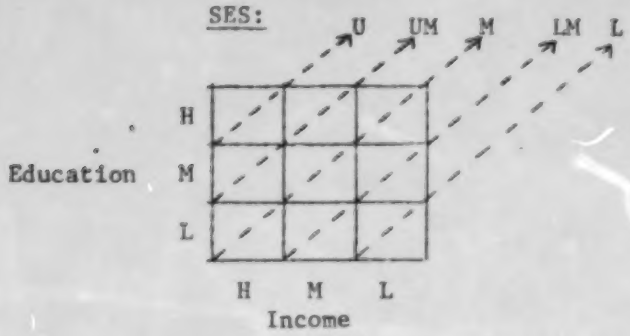
Indices are critical aspects of quantification as language. Often the concepts and relationships one wants to describe are not amenable to simple verbal analysis, generally because they cannot be articulated using a word vocabulary or because they are too complex to be analyzed parsimoniously. Indices attempt to synthesize and simplify multidimensional phenomena so as to incorporate them into a vocabulary of figures.

You undoubtedly use indices in your everyday conversations, perhaps without even realizing it. Economic indices are ubiquitous-GNP, the wholesale and retail price indices, the cost of living index, the rate of inflation, and the Dow Jones average are typical. In baseball we use indices such as batting averages, runs-batted-in (RBI's), and earned run averages (ERA) to indicate atheletic performance and to facilitate our conversing about otherwise complicated dimensions of the sport. Beauty contests, gymnastic events, and diving contests likewise use indices in judging winners. School performance is indicated by GPA, and knowledge is indexed by devices such as GRE scores. At a more abstract level, we describe intelligence by an index of IQ and social class by a measure of SES. Indices may be constructed in a number of ways. This section will introduce you to several techniques illustrating the diversity.

We begin with a very simple procedure for measuring socio-economic status (SES). There is no standard index of SES, but there is consensus on its component indicators-income, educational level, occupational prestige, or a subset of these. Suppose we want to index SES using income and education. If each component variate has high, medium, and low categories, their cross-classification yields the following table:



The cross-classification determines a five-category SES index for the different combinations of categories that follow:



Thus, an individual with high income and high education is classified under upper SES, while an individual with high income and low education is classified under middle SES. This procedure exemplifies a relatively unambiguous profiling method.

1) As an aside, consider the outcome of this procedure had the arrows of Table ____ run perpendicular to those shown (i.e., in the direction of the main diagonal).
   a) Construct the table with this configuration of arrows.

   b) What is the name of the index constructed through your table? (You may not be familiar with the common label, but you can see what it indicates by examining the category-pairs).

Beyond profiling, the procedure discussed above gives a structure for a simple summated index--a type of index constructed by adding the variates:

$$Y = \sum_{i=1}^{k} X_i = X_1 + X_2 + \ldots + X_k$$

where,

Y is the computed index value
X_i is the value of the i^{th} component variate.
k is the total number of component variates.

Let us assign numbers to the categories as follows: L → 0, M → 1, H → 2. Then filling the table cells with the sum of contingent category codes results in Table .1, a table containing index scores for SES as follows: L → 1, M → 2, UM → 3, U → 4. Thus a person with medium education level (X_E = 1) and low income (X_I = 0) is assigned an SES score equal to 1 (i.e., SES = $X_E + X_I$ = 1 + 0 = 1).

Education	Income 2 (H)	Income 1	Income 0 (L)
H 2	4	3	2
1	3	2	1
L 0	2	1	0

2) Compute the mean SES score (using a simple summated index as described above) for a group of families distributed by Income and Education as follows:

Education	Income L	Income H
L	10	15
H	10	5

40

More complex indices of SES are typically formed under regression analyses and may be viewed simply as weighted indices - indices constructed by summing numerical values of the component indicators, each adjusted by a weighting factor to reflect its relative contribution to the index. Of interest here are adjustments made by multiplying raw indicator values by num-

bers which will either increase or decrease an indicator's magnitude.

The details of constructing weighted indices involve theoretical issues and measurement problems far beyond the scope of our interests here. However, to give you a feeling for how weighted indices may complement your understanding of an intricate phenomenon, we shall work here with a trivialized measure of SES.

Suppose your research requires a measure of family social class and you have available data on families which include the highest level of education attained by the most educated member, the combined income of all members, and an index of prestige for the most esteemed of the members' occupations. For each of the three dimensions, assume that the indicator values range from 0 to 5 with higher scores corresponding to higher status. Let us assume further that, regardless of the specific values any of the indicators may take, each contributes a fixed proportion of the overall index of SES.

For example, if you believe that education, income, and occupation contribute equally to SES, then you would say that each contributes .33 of the final SES index value. But if you feel that occupation contributes a great deal more than income, and income somewhat more than education, you might regard the proportionate input of occupation as, say, 145; of income as .30; and of education as .25. In the first case you apparently have no use for a weighted index; in the second case, you have already suggested a weighting schema--each of the indicators can be multiplied by its proportionate weight to adjust its contribution to the SES index.

A general formula for a weighted summated index is

$$Y = \sum_{i=1}^{k} w_i X_i,$$

where,

Y is the index value
X_i is the value of the i^{th} indicator
w_i is the weighting factor for the i^{th} indicator
k is the total number of indicators

Using the hypothetical weights suggested above, a family with very high occupational prestige (X_1 (occupation) = 5), with medium income (X_2 (income) = 3), and with moderately high education (X_3 (education) = 4) would have an SES score of 4.15, computed as follows:

Indicator	Category Value	x	Weighting Factor	=	Partial Score
X_1 occupation	5		.45		2.25
X_2 income	3		.30		.90
X_3 education	4		.25		1.00
SES =					4.15

or, using the computing formula,

$$SES = w_1X_1 + w_2X_2 + w_3X_3$$

$$= .45 \cdot 5 + .30 \cdot 3 + .25 \cdot 4$$

$$= 2.25 + .90 + 1.00$$

$$= 4.15$$

3) Another family has medium occupational prestige ($X_1 = 3$), but very high income and education ($X_2 = X_3 = 5$). Is this family's SES higher or lower than the family in our example?

4) Suppose the category values for each component indicator ranged from 0 to 2 (rather than 0 to 5) but the weighting factors are those used above. Construct a table showing all possible SES scores which may be generated under the procedure discussed in this unit.

Sociometric Indices

Sociomatrices, such as that on p. 24 in the text, represent essentially qualitative relationships in a form amenable to quantification. In what follows we shall examine some indices used to indicate selected facets of those relationships. The examples used here focus on sociometric studies of the sort which request subjects to choose others in a group according to some specified criterion. For instance, in Coleman's Adolescent Society, the "association structures" of each school were depicted in sociograms constructed from the students' reports of who they "go around with most often". Bear in mind that sociometric methods are not limited to unweighted affective relationships; they may be applied to a wide range of relationships including those among whole groups as might be done in analyzing the functional dependencies of organization departments.

As you work with these indices, try to evaluate them for your own purposes on the basis of your intuitions about small groups. The first exercise is intended to facilitate your articulating those intuitions.

1) If you are not familiar with sociomatrices, you may find it useful to draw a picture (sociogram) of the relations described. Complete the sociogram of figure __.1 by drawing an arrow indicating the relationships summarized in the sociomatrix. (Each unit is represented by a circle; an arrow from one circle to another indicates that the first "chose" the second; a double arrow indicates reciprocal choices.)

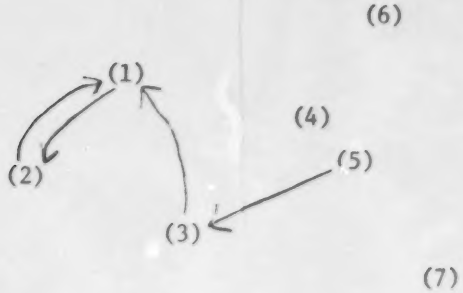


Figure __.1

Zeisel has suggested eight indices which may be used to describe sociometric data and thus elements of group structure. Each of these measures is discussed briefly below. Study each method and be prepared to compute the index for the data in the sociomatrix that follows.

Index 1 - Mean score received - This index measures an individual's acceptance by the group using the mean of the scores he is given by other group members. It is computed for each individual by summing the scores he received and dividing by the total number of other persons in the group (i.e., N-1).

Index 2 Average Deviation from the mean score received - This measures the mean deviation for Index 1 as an indication of the unanimity with which each individual was chosen. Unanimous selection is reflected in a mean deviation score of zero. Index 2 is computed for an individual by summing the absolute values of the difference between a score received and the mean score received (Index 1) and then dividing by N-1.

Index 3 Mean score expressed - In contrast to Index 1, this index measures the extent to which an individual accepts other group members by selecting them. It is the total of the scores he gives divided by the total number of others.

Index 4 Average deviation from the mean score expressed - This is the mean deviation from Index 3. It expresses the degree to which an individual discriminates in selecting other members of the group.

Zeisel's fifth and sixth indices involve correlations. Computational procedures for these will not concern us here, but you should be certain to understand their purposes.

Index 5 A measure of rank correlation between the scores expressed by one individual towards the other members of the group, and the score he received from each of them. This indicates the degree to which a given individual

reciprocates being chosen by selecting others. (Correlation coefficients vary from -1.00 to +1.00. The strength of the relationship is indicated by a value other than zero such that the greater its distance from zero, the stronger the association. The sign of the coefficient corresponds to the direction (positive or negative of the relationship).

Index 6 A measure of correlation between the scores expressed for each individual and the general mean score (Index 1) of acceptance of each individual. The higher the correlation, the greater the conformity of the scores expressed by each individual with the group opinion.

Index 7 The mean of the score given and the score received between any pair of individuals. This is an index of pairwise affinity.

Index 8 The mean of all scores. This is a measure of group cohesiveness.

The sociomatrix in the text simply indicates the presence or absence of an association between individuals. Now let us assume that each 'X' is a measure of degree of association, ranging from 0.0 (no association) to 1.0 (strong association), as might have been found by asking subjects not only who they chose but how much they liked each other. Table .1 is the corresponding valued sociomatrix.

	Chosen						
Chooser	1	2	3	4	5	6	7
1	---	1.0	.5	0.	0.	0.	0.
2	1.0	---	.5	0.	0.	0.	0.
3	1.0	1.0	---	0.	0.	0.	0.
4	0.	0.	0.	---	.5	1.0	0.
5	0.	0.	.5	0.	---	0.	1.0
6	1.0	0.	0.	.5	0.	---	0.
7	0.	0.	.5	0.	0.	.5	---

2) Complete the tables by computing the appropriate sociometric index for each blank using data from Table .1.

Individual

	1	2	3	4	5	6	7
Index 1 Acceptance	.50	.33		.08	.08		.17
Index 2 Unanimity of Acceptance		.44	.22	.14	.14		.28
Index 3 Active Sociability	.25	.25	.33		.25	.25	
Index 4 Discrimination in Sociability	.33		.44	.33		.33	.22
Index 5 Reciprocity	.77	.99	.66	.86	.26	.44	.27
Index 6 Choice Conformity	.86	.87	.86	-.30	0.0	.39	.27

Index 7 Pairwise Affinity

Individual						
2	1.0					
3		.75				
4	0.0		0.0			
5	0.0		.25	.25		
6	.50	0.0	0.0		0.0	
7	0.0	0.0	.25	0.0	.50	
	1	2	3	4	5	6

Individual

Index 8 Group Cohesiveness = _____

Answer each of the following questions, and cite evidence for your response by giving the supporting index value.

3) Which individual(s) shows the greatest readiness to accept others in the group?

4) Which individual(s) is(are) most selective in accepting others?

5) Who is most unpopular?

6) Whose popularity has the greatest consensus?

7) Which individuals have the most affinity for one another (list the pairs)?

8) Who is least conforming in choices of others?

9) Who is most conforming in choices of others?

10) Who is least reciprocating in choosing others?

11) Describe the group's cohesiveness in terms of quantitative evidence, and discuss that evidence in light of your qualitative knowledge of the group (i.e., with reference to the sociogram).

The measures introduced here are by no means exhaustive of the possible sociometric indices. Some fairly sophisticated indices have been developed for studying clique structures and hierarchical relationships. The interested reader will find it most worthwhile to explore such possibilities for analyzing groups.

The Language of Matrices

In expressing ideas about pairs of units or pairs of attributes, it is often necessary to summarize a great deal of information in some simple, interpretable fashion. If you are studying a class of 20 students to describe the nature of friendship relation between each possible pair (as, for example, in determining if one student likes another), you will have to work with 20 x 20 = 400 possible relationships. Rather than listing so many pairs, you can construct a table cross-classifying the 20 students, i.e. a 20 x 20 matrix.

You are already familiar with the fourfold tables summarizing bivariate distributions of dichotomies, and with how the table facilitates the interpretation of relationships between the variates. The fourfold table is a 2 x 2 matrix--the simplest manifestation of matrices in the language of quantification.

Information about pairs may be displayed by employing matrices, which appear as tables to describe the relationship between two variates--the pairs being the cross-classification of one variate's categories with the other's. Matrices are used to display sociometric data (e.g., friendship, deference, authority, communication, etc.), as in the sociomatrix of the text. Matrices also facilitate analysis of data over time, as in panel analyses, and studies of turnover and mobility.

Table ___.1 is the general form of a matrix with r rows and c columns (an r x c matrix). Its typical entry, m_{ij}, is the value appearing at the intersection of the i^{th} row and the j^{th} column. A matrix with the same number of rows and columns (r=c) is called a square matrix. An obvious feature of a square matrix is that all entries, m_{ii}, form a diagonal from the upper left-hand corner to the lower right-hand corner--the main diagonal.

Table .1 A General r x c Matrix

		columns					
		1	2	3 ...	j ...	c-1	c
	1	m_{11}	m_{12}	m_{13}	m_{1j}	$m_{1(c-1)}$	m_{1c}
	2	m_{21}	m_{22}	m_{23} ...	m_{2j} ...	$m_{2(c-1)}$	m_{2c}
rows	3	m_{31}	m_{32}	m_{33}	m_{3j}	$m_{3(c-1)}$	m_{3c}
	:		:		:	:	
	i	m_{i1}	m_{i2}	m_{i3} ...	m_{ij} ...	$m_{i(c-1)}$	m_{ic}
	:		:		:	:	
	r-1	$m_{(r-1)1}$	$m_{(r-1)2}$	$m_{(r-1)3}$	$m_{(r-1)j}$	$m_{(r-1)(c-1)}$	$m_{(r-1)c}$
	r	m_{r1}	m_{r2}	m_{r3} ...	m_{rj} ...	$m_{r(c-1)}$	m_{rc}

Suppose you want to display differences in school absentee rates for five schools. Table .2 gives a general matrix set up for this problem. The notation n_i stands for the absentees in the i^{th} school; accordingly, $n_i - n_j$ is the difference in absentee rates between the i^{th} and the j^{th} school.

Table .2 A General Matrix for

School

	1	2	3	4	5
1	n_1-n_1	n_1-n_2	n_1-n_3	n_1-n_4	n_1-n_5
2	n_2-n_1	n_2-n_2	n_2-n_3	n_2-n_4	n_2-n_5
3	n_3-n_1	n_3-n_2	n_3-n_3	n_3-n_4	n_3-n_5
4	n_4-n_1	n_4-n_2	n_4-n_3	n_4-n_4	n_4-n_5
5	n_5-n_1	n_5-n_2	n_5-n_3	n_5-n_4	n_5-n_5

1) The absentee rates for five schools are as follows: $n_1=5$; $n_2=8$; $n_3=7$; $n_4=12$; $n_5=10$. Construct a matrix showing the differences in rates among the schools.

2) What is the mean difference in rates for the schools?

In a later unit we shall see how matrix information similar to what you just computed contributes to the construction of some highly sophisticated indices.

The Conceptual Interpretation of Fourfold Tables

A fourfold table (FFT) provides an abundance of numerical information--the cell entries represent a bivariate distribution of units under each combination of categories from two dichotomous variates; the marginals are the totals of units under each category of the variates considered separately; the grand total is the total number of units under study. But in spite of this abundance of numerical information, it will very often happen that a FFT is treated as a numerical representation of one single concept. For example, if the two dichotomies are the answer to the same question asked at two different periods of time, the FFT indicates the stability of the reply (this is usually "measured" by the so-called phi-coefficient). A typical example is the following turnover table from a study of intentions to go to college (Pasanella, 1974).

Table 1: The Stability of College Plans from 10th to 12th Grade

	10th Grade	
12th Grade	Plan to Go to College	Do Not Plan to Go to College
Plan to Go to College	84%	20%
Do Not Plan to Go to College	16 4360	80 4042

In this unit we shall analyze tables representing two different concepts--effect and bias. The notion of effect was discussed in the main text for Hovland's study of a movie's influence on soldiers' attitudes. Another concept which may be represented by a FFT is the notion of "bias". It should be remembered that the term bias has two different uses. One refers to discrimination; and the other a perception colored by one's own attitude. The typical example here is the tendency of people to expect the victory of a political candidate whom they themselves favor. This is exemplified in Table 2.

Table 2: The Relationship Between Political Preferences and Expectations For Victory

	Candidate You Want to Win:	
Candidate You Expect to Win:	Republican	Democrat
Republican	X	
Democrat		X

Once a FFT is chosen to represent a specific concept, say the notion of political bias, it is then possible to compare various subgroups of a sample according to their degree of bias. This was done in a study of an election poll taken in 1948 in Elmira. The respondents were first classified by two variates: their own vote intention (only the two main parties are included) and whether respondents grew up in a city or in a rural area (the precise distinction is irrelevant here). The sample divided itself according to the following FFT.

Table 3: Bivariate Frequency Distribution of Respondents in the Elmira Voting Study

	Region of Origin		
Party	Farm	Town or City	
Republicans	80	71	151
Democrats	24	123	147
	104	194	298

The respondents were further asked how the majority of farmers in their county are likely to vote in the forthcoming election. Table 4 shows the percentage of respondents in each quadrant of Table 3 who think that the majority of farmers will vote Republican.

Table 4: Percentages of Respondents from Different Regions and Political Parties who Believe Farmers Will Vote Republican

	Region of Origin	
Party	Farm	Town or City
Republicans	90%	71%
Democrats	42%	58%

It is easily seen that the perceptions of both country and city people are politically biased. The respondents estimate a larger proportion of Republican farmers if they are themselves Republican.

1) Reflect on the parts of Table 4 which represent this result. Construct a "conditional" fourfold table to demonstrate the finding.

2) Table 4 also shows the effect of the area in which people grew up. Here the FFT represents a concept similar to the one discussed in the main text. Compare the differences in the influence of Region for Republicans and Democrats by computing an effectiveness index for each.

Now that we have established two conceptual ideas - effect and biased perception - we can ask how background effect and biased perception are related. The result is rather surprising. People are more biased in the estimation of their own group than in the estimation of the "other" group. This requires a rather careful study of Table 4. The differences between the percentages in the upper row are larger than those in the lower row.

3) Try to explain this result. Keep in mind that, as shown in many election studies, groups of personal friends are very likely to have the same vote intention; this is usually established by asking respondents how their friends intend to vote. In social theory this matter is discussed under the concept of homophyly. How would this concept be reported by a FFT?

One might understandably ask whether this whole result is just a coincidence. Table 6 was constructed to test the possibility. It gives in very condensed form the same type of result, but instead of dividing the sample by the area in which they grew up, they are classified according to their socio-economic status (SES)(only the highest and lowest categories are shown here). The question the respondents had to answer was "how do you think the majority of poor people will vote?"

Table 5: Percentages of Respondents of Different Socioeconomic Status and Political Party Who Believe Poor People Will Vote Republican

Political Party	Socioeconomic Status (SES) Low	High
Republican	67% (165)	37% (89)
Democrats	87% (81)	82% (11)

4) Reconstruct the steps which led to Table 5 (as was done for Table 4).

5) a) Is the same numerical device used to obtain the result in Table 5 as was used in Table 4? Explain.

b) Can you find a new result by comparing the quadrants of Tables 4 and 5?

The tables discussed above lead to the following generalization: people are more biased in judging the intention of an ingroup to which they belong rather than an outgroup.

6) The generalization sounds like a relation between two concepts.

a) How many variates were involved in establishing the result?

b) One of the variates is not a dichotomy--which one?

Notice that this general result is independent of whether the guesses of the respondents are correct. Actually, in that Upstate New York election, rural people voted more Republican than city people and most higher SES people voted more Republican than lower SES groups.

An Index of Degree of Association

I. Very often one wants a measure of the strength of the relationship between variates in a table. Any textbook in statistics will contain measures of association appropriate for the data under study. Here we shall be content to examine a very simple measure which is readily computed from percentage tables. In our earlier discussion of the relationship between union identification and political involvement (Table 1), the relationship was described through a comparison of the percentages for categories of the independent variate. We simply looked at the difference between them to form an intuitive judgement about the direction and strength of the relationship. A measure of the difference between percentages (call it D) is computed for a given category of the dependent variate by subtracting the percentages under a pair of independent variate categories: $D = P_2 - P_1$. Thus, D is simply a number describing what we look for intuitively when reading a percentage table. It is generally used with fourfold tables, but may be applied to any percentage table.

The direction of the relationship is indicated by the sign of D (of course the direction inferred from the sign is determined from the set-up of the table). D is positive if the relationship is positive; D is negative if the relationship is negative. For the sake of consistency and under the convention of percentaging by columns, D is computed by subtracting the percentage on the right from the one on the left.

Referring back to Table 1, we can compute a different D for each pair of figures in each row. Let us do this for the first row (High Political Involvement). There are six ways of pairing categories of Union Identification, and thus six D's.

1) Complete the following table of D's for the first row of Table 1;

Pair	D
1,2	3
2,3	-12
3,4	
1,3	-9
2,4	
1,4	

Normally, the D's of most interest are those for adjacent categories - pairs (1,2), (2,3), (3,4) in the above problem - and those for the lowest and highest categories - pair (1,4) above. The signs of pairs in the former group indicate the consistency of the relationship for the dependent variate category examined. In the first row of Table 1 we expect each D to be negative; such is true for all but the first pair where there is a small positive difference.

The percentage difference for the highest and lowest categories of a row indicates the overall strength and direction of the relationship for that row. If you compute such a D for each row you can determine the overall consistency of the relationship while gaining further insight into the strength of the relationship as a whole. A consistent relationship will be reflected in a table whose most positive and most negative D's are measures on the extreme categories of the dependent variable. The percentage differences for the remaining rows (if any) should be consistently ordered in between.

Computing D for the "least" and "most identified" pair of each row in Table 1 yields (from "High to Low Political Involvement"): $D_4 = -17$, $D_3 = -4$, $D_2 = 5$, $D_1 = 16$. This is evidence of a reasonably strong, consistent relationship.

2) Refer to Table 1.4 (Self-Esteem of Secondary School Children). Fill in the following table with D's for the pairs indicated:

	Pairwise Differences in Marks			
Self-Esteem	A,B	B,C	C,D	A,D
High	28			
Medium		-3		
Low			-13	

3) Use your table of D's to describe the consistency of the relationship between Self-Esteem and Marks in School.

4) Explain your findings for $D_{A,B}$, $D_{B,C}$, and $D_{C,D}$, in the Medium Self-Esteem category.

5) Describe the overall strength and consistency of the relationship in terms of D's.

II. McDill and Coleman (1963) studied the interrelationships among the Social Status, Achievement Orientation, and College Plans of a cohort of students from six high schools in northern Illinois during their freshman and senior years (1957 and 1961). A student's Social Status in the adolescent social system was indicated by his being perceived as a member of the leading crowd by other students. Perceptions at both times were recorded under a sociometric procedure whereby a student receiving no choice or one choice was classified as having low social status, and those with more choices were high in social status. College Plans were ascertained by simply asking whether or not a student planned to go to college after high school. Achievement Orientation was indicated by a student wanting to be remembered at school as a "brilliant student."

Tables .1a and .1b show the relationships between High School Class and College Plans, and between Class and Achievement Orientation.

Table .1a The Relationship Between High School Class and College Plans

	Class	
	Freshmen	Seniors
College Plans		
Yes	48%	44%
No	52	56
	(602)	(602)

Table .1b The Relationship Between High School Class and Achievement Orientation

	Class	
	Freshmen	Seniors
Achievement Orientation		
High	33%	29%
Low	67	71
	(554)	(554)

1) Use D to describe the relationship between High School Class and College Plans.

2) Use D to describe the relationship between High School Class and Achievement Orientation.

Notice that in describing the relationships in Tables .1a and .1b it would be improper to infer that the aggregated relationship holds for individuals, i.e., that individuals are unaffected by high school. It is always possible that individuals have changed considerably but that the aggregated outcome of those changes leaves the overall relationship unaltered. The obvious way to test such a possibility is to analyze the "turnover" in plans and orientations from 1957 to 1967, i.e., to study the seniors given their plans and orientations as freshmen. If there was little change, then nearly 100 percent of the students with a particular plan or orientation as freshmen should have the same plan or orientation as seniors. Tables .2a and .2b present data relevant to this concern. Study the tables carefully, thinking about their possible interpretations. They suggest a few special uses of D.

Table .2a The Effect of High School on College Plans

College Plans in 1961	College Plans in 1957	
	Yes	No
Yes	75%	27%
No	25	73
	(267)	(335)

Table .2b The Effect of High School on Achievement Orientation

Achievement Orientation in 1961	Achievement Orientation in 1957	
	High	Low
High	58%	23%
Low	42	77
	(161)	(393)

3) For students who planned on college as freshmen, what is the percentage difference between them as freshmen and as seniors who still planned on college, i.e., what percentage changed their plans?

4) What is D for the percentage of those students planning on college in 1957 who did not change and the percentage of those not planning on college in 1957 who did not change?

5) What is the difference between the percentage of those students who had planned on college as freshmen and did not change and the percentage of the students who did not plan on college as freshmen but did as seniors?

6) Which of the above measures most directly indicates the effect of high school on plans or orientation?

7) Which indicates the uniformity of effects on plans or orientations?

8) Discuss the third application of D in light of your responses to the above two questions.

9) Evaluate and discuss the effect of high school on Achievement Orientation as represented in Table .2b.

Finally, using D may facilitate discussion of changes in relationships over time. For example, McDill and Coleman were concerned with changes from freshman to senior years in the relationship between College Plans and Social Status and between Achievement Orientation and Social Status. Tables .3a and .3b present their findings.

Table .3a The Relationship Between Social Status and College Plans for a Cohort of Students as Freshmen and Seniors

	Freshmen		Seniors	
College Plans	High Social Status	Low Social Status	High Social Status	Low Social Status
Yes	59%	45%	66%	36%
No	41	55	34	64
	(144)	(458)	(169)	(433)

Table .3b The Relationship Between Social Status and Achievement Orientation for a Cohort of Students as Freshmen and as Seniors

	Freshmen		Seniors	
Achievement Orientation	High Social Status	Low Social Status	High Social Status	Low Social Status
High	25%	57%	22%	32%
Low	75	64	78	68
	(136)	(418)	(160)	(394)

Answer the following questions about Tables .3a and .3b making reference to relevant percentage differences:

10) Describe the relationship between social status and intentions to going to college for freshmen and seniors.

11) How did the relationship between social status and college plans change between the students' freshman and senior years?

12) Describe the relationship between social status and achievement orientation for freshmen and seniors.

13) How did the relationship between social status and achievement orientation change over four years?

Organizational Variates

This section deals with organizational measurement - the ways in which organizations can be described using variates. Several examples were described in the text. These included measures of morale, numbers of supervisory levels or departments, size, span of control, organizational shape, types of individual activities (job categories), concentration indices, etc. The rise in importance of organizational variates is associated with the increasing interest in organizations as units for empirical analysis. It is now a widely held belief that propositions about organizations can be stated and tested in quantitative terms. New insights about organizations may arise through continued analysis of organizational variates. Moreover, since an organization's members can be described using measures on the organizations, organizational variates provide measures which may give rise to new information about structural influences on individual behavior.

Excercise I

1-A To begin the exercises in this section it is helpful to think about some familiar organizational variates and their sources of data.

In The Academic Mind, Lazarsfeld and Thielens classified colleges using three different organizational variates: type of control, size of student enrollment, and academic quality. Type of control had two aspects--curriculum emphasis and state versus private control; these were partitioned and combined into five types of schools: private, public, teachers college, Protestant, and Catholic. Each college in the study was assigned to exactly one category using information available through published documents. Size

was a simple four-category variate formed by grouping student enrollment figures under the following classification scheme:

	Number of Students
Very Small	Up to 700
Small	700-2500
Large	2500-9000
Very Large	9000 or more

Quality was indicated by the average score of six variates believed to reflect overall status. These included the following: size of library, books per student, budget per student, proportion of Ph.D.'s on faculty, production of scholars, and tuition fees.

1) The above are but a fraction of the organizational variates associated with universities. What additional variates might be used to describe colleges and universities as organizations? List at least five and suggest possible data sources for each.

The organizational variates used by Lazarsfeld and Thielens proved to be important predictors of faculty perceptions and attitudes. In addition, they led to some surprising findings on the effects of attacks on academic freedom. For example, Table 1 shows on unexpected finding: in private colleges, the higher the political pressure infringing on academic freedom, the higher the administration protection rate; but in public colleges the relationship is reversed--protection apparently declines as pressure increases. If you construct conditional tables in attempting to explain this finding,

you will discover that all the pairwise relationships between the variates are negligible. There is obviously something in the nature of the control of the colleges that influences the relationships between pressure and protection.

Table 1. The Percentage of Secular Colleges with High Administrative Protection by Degree of Pressure and Type of College.

	Type of College	
Political Pressure	Public	Private
High	31% (16)	67% (12)
Low	67% (15)	38% (16)

2) What is in the nature of college control that can account for the results in Table 1?

3) How would you demonstrate your explanation using fourfold tables? (Draw an "empty" table(s) which you would use.)

1-B Organizations are often characterized in terms of their goals, and an organization may be evaluated on the basis of its adequacy in attaining its goals. One of the quantification problems in organizational research is to measure the importance of various goals. The problem is confounded by theoretical ambiguities on such factors as what constitutes a goal, the distinction between organizational goals and personal goals, and a determintion as to who can say what are the organization's goals.

Edward Gross studied 68 non-denominational American universities in terms of their goals. He chose to ascertain what their goals were by surveying (using mail-out questionnaires) administrators and faculty members at each university. The respondents were presented with 47 statements of university goals, classified under the following categories:*

A) Output Goals - "those goals of the university which are reflected, immediately or in the future, in some product, service, skill or orientation which will affect (and is intended to affect) society."

B) Adaptation Goals - "those goals which reflect the need for the organization to come to terms with the environment in which it is located. These revolve about the need to attract students and staff, to finance the enterprise, secure needed resources, and validate the activities of the university with those persons or agencies in a position to affect them."

C) Management Goals - "those goals which reflect decisions on who should run the university, the need to handle conflict, and the establishment of priorties on which output goals are to be given maximum attention."

D) Motivation Goals - "those goals which seek to ensure a high level of satisfaction on the part of staff and students, and which emphasize loyalty to the university as a whole."

E) Positional Goals - "goals which serve to help maintain the position of this university in terms of the kind of place it is in comparison to other universities, and in the face of attempts or trends which could change its position."

*The interested student should refer to Gross (1968) for a full discussion of the goals.

Respondents were asked to indicate for each goal how important it is at his university and how important it should be on a five-point scale ("of absolutely top importance" to "of no importance"). An overall characterization of the university in terms of the importance of the goals was found by ranking the goals according to the mean score each received.

Table 2 gives the mean rank of goals within each goal set in terms of how important the respondents felt the goals are and how important they should be. The table reflects the notion of goal congruence--a potentially important organizational variate for predicting sources of intra-organizational conflict, especially in universities where professional interests may clash with organa-tional needs.

Table 2. Congruence of University Goals as perceived by Faculty Members and Administrators.

	Mean Rank	
	Is	Should Be
Output (17)	21.9	20.8
Adaptation (7)	23.6	33.0
Management (10)	30.8	26.6
Motivation (7)	26.1	24.4
Positional (6)	16.5	17.7

1) Discuss the nature of goal congruence suggested by Table 2, indicating how incongruencies reflect conflicts of interest.

2) Construct an index of goal congruence for the data in Table 2. (Select a simple method, but justify its use.)

The top goal on both the "is" and "should be" scales was "protect the faculty's right to academic freedom" (a motivational goal). However, not all schools place equal emphasis on academic freedom. Gross constructed a variate to categorize each university according to its degree of emphasis on academic freedom (low, medium, or high). The frequencies for this variate by the type of university control (state or private) are displayed in Table 3.

Table 3. Emphasis on Academic Freedom by Type of Control

	Type of control	
Degree of Emphasis on Academic Freedom	State	Private
Low	20	3
Medium	13	9
High	9	14
	42	26

3) Describe and try to offer an explanation for the finding of Table 3.

4) How does Table 3 complement your answers to question (2) and (3) of section 1-A?

Exercise II

The organizational variates of Table 14 are of two different types: a structural division of the organization (departments) and rates imputed to the departments from the behavior of their members (indicators of morale). This is an important type of table quite common in organizational analyses.

II-A If you did not immediately understand Table 14, answer the following questions to check yourself. Otherwise proceed to the next section.

1) What are the units of this table?

2) What was the source of the data for this table? (refer to the text)

3) How many variates make up the table?

4) Which of the variates would you consider a simple element (or indicator) and which are indices?

5) How many points in time are represented by the data in this table?

6) What is the nature of the numbers displayed in the table (are they raw data, percentages, scale scores, or what)?

7) Describe the dependence relation or causal structure of the variates in the table. Are any variates assumed to be causing others? (if yes) Which one(s)? Which variate is dependent? Are any of the variates stratifiers?

II-B Bearing in mind that each of the indicator of Table 14 is supposed to tap a different facet of "discontent" or "morale", answer the following questions:

1) Describe the "silent scale" of Table 14.

2) Which department is characterized by the highest morale?

3) Which department has the lowest morale?

Answers to the above two questions suggest a rank-ordering of departments by morale.

4) Arranging the departments from high to low on the basis of morale, all but one indicator is perfectly consistent with the arrangement. Which one isn't?

5) Which two departments are most similar in morale?

6) The morale of the third is clearly (higher/lower).

Evan was actually using the morale measures as indicators of role strain in a department. He hypothesized that there would be a positive relationship between organizational pressures and role strain.

7) What additional information do you need to test the hypothesis (i.e., what assumptions would you have to make with respect to the information in the table)? (Hint: Assume, as did Evan, that role strain is the "felt difficulty in fulfilling role obligations" (df. from Goode). What else must be assumed?)

8) Given that your subsidiary assumption is true, was Evan's hypothesis confirmed?

II-C Now let us examine a complex table, similar to Table 14 in many respects, dealing with measures over many organizations rather than subunits of a single organization. The data is from teachers' responses to questionnaires in the Educational Opportunities Survey and is reported in the Coleman Report (Equality of Educational Opportunity). The table is typical of a great many of the tables in the Report.

Study Table 14.1 and its supporting information carefully, then answer the questions which follow.

Table 14.1 For schools attended by the average white and Negro pupil, teachers' attitudes on their profession, their school, and their students, for the United States, Fall, 1965

	Type of School					
	Elementary			Secondary		
	N	W(N)	W	N	W(N)	W
Percent who would definitely reenter teaching if they had it to do again	54	57	57	42	45	43
Percent who plan to remain in teaching until retirement	45	39	37	38	35	33
Percent who would continue teaching in their present school	55	68	65	46	55	51
Teacher's rating of student effort (1)	1.9	2.4	2.4	1.8	2.2	2.3
Teacher's rating of student ability (1)	1.9	2.4	2.4	2.0	2.3	2.4
Teacher's perception of reputation of their school among outside teachers (1)	2.7	2.9	2.9	2.6	2.8	2.8
Teacher's problems with students and their homes (2)	.19	.10	.08	.20	.13	.11
Teacher's problems in school functioning (2)	.11	.07	.06	.11	.09	.08

Key: N - Negro; W(N) - whites in the same county as Negroes (a weighting of measures on schools with whites in each county proportional to the number of Negroes in the county); W - white

(1) Higher scores indicate superior ratings

(2) Higher scores indicate greater problems

1) What are the units of this table?

2) What was the source of the data for this table?

3) How many variates make up the table?

4) How many points in time are represented by the data in this table?

5) What is the nature of the numbers displayed in the table (are they raw data, percentages, scale scores, or what)?

6) Describe the dependence relation or causal structure of the variates in the table. Are any variates assumed to be causing others? (if yes) Which one(s)? Which variate is dependent? Are any of the variates stratifiers? (if yes) Which one(s)?

The following questions are in the form of the "highlights" of findings reported by Coleman, et al.

In comparison to the average white, the average Negro pupil's school has teachers who are (fill-in with "more", "less" or "equally")

7) more/less/equally likely to claim they would reenter teaching if they could decide again.

8) more/less/equally likely to remain full-time in public education until retirement.

9) more/less/equally likely to desire to remain in their present school if they could change.

10) more/less/equally likely to rate their students low in effort.

11) more/less/equally likely to rate their students high in ability.

12) more/less/equally likely to perceive their school as having a low reputation among outside teachers.

13) more/less/equally likely to have problems with students and their homes.

14) more/less/equally likely to have problems with the school's functioning.

Compared to the average secondary school pupil, the average elementary pupil attends a school in which teachers are

15) more/less/equally likely to remain full-time in public education until retirement.

16) more/less/equally likely to desire to leave their present school if they could change.

17) more/less/equally likely to have problems with students and their homes.

Exercise III

We have already examined some of the different ways that variates can be combined to form new variates. It may be the case that the units under investigation can best be described not in terms of the combined variates, but by the relationship between elemental variates, as in Table 15.

Table 15: Correlation of Size and Span of Control

Level of Supervisor:	Division Head	Middle Manager	Front Line Supervisor
	.07	.22	.40

III-A Answer the following questions with respect to Table 15. Be sure to refer to the text if you are uncertain.

1) What are the units of this table?

2) What was the source of the data for this table? (refer to introduction)

3) How many variates make up the table?

4) Which of the variates would you consider a simple element (or indicator) and which are indexes?

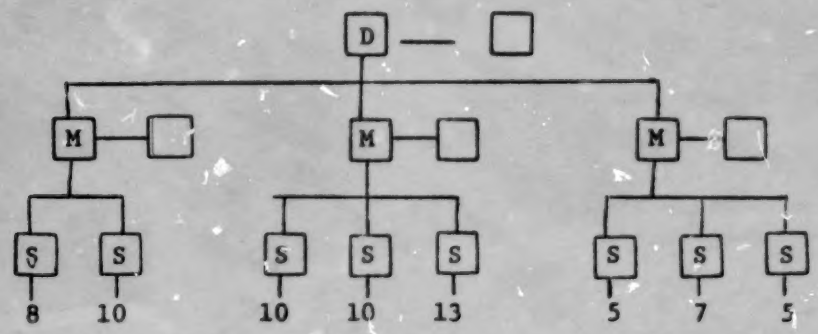
5) How many points in time are represented by the data in this table?

6) What is the nature of the numbers displayed in the table (are they raw data, percentages, scale scores, or what)?

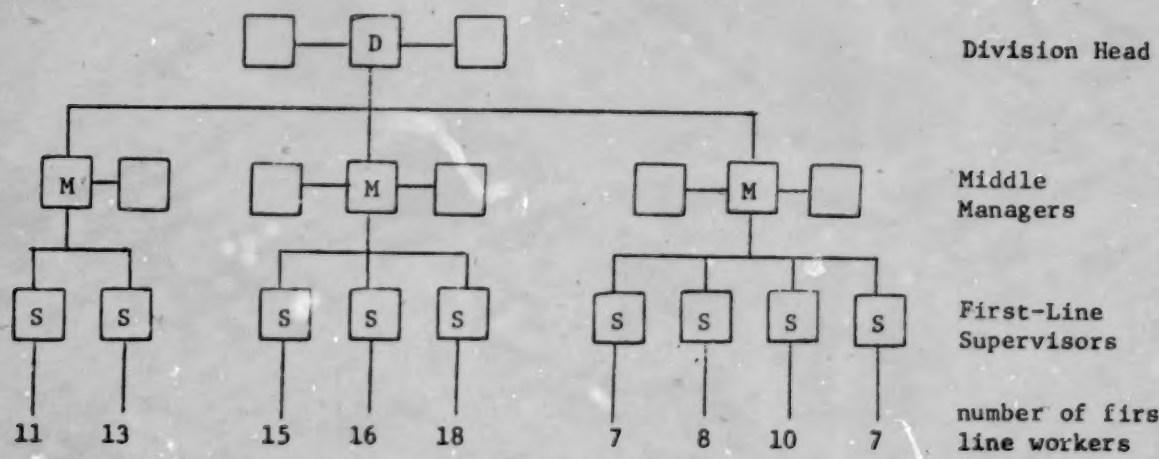
7) Describe the dependence relation or causal structure of the variates in the table. Are any variates assumed to be causing others? (if yes) Which one(s)? Which variate is dependent? Are any of the variates stratifiers? (if yes) Which one(s)?

III-B In Table 15 the relationship between agency size and employees per supervisor is given for each of three categories of supervisor levels. If one thinks of the span of control of each level of supervisor as three different variates, then Table 15 may be read as a display of three bivariate relationships--the correlation of size and 1) the span of control of a division head; 2) span of control of middle managers; 3) span of control of first-line supervisors. In fact, this is how the relationships were originally presented by Blau.

relatively homogeneous activities and size is more flexible. Test this explanation by considering a hypothetical organizational division changing in size but not function. Assuming that organizational functions determine organizational structure (Blau and Schoenherr argue that this is true), then let us suppose that the division can be described by the following hypothetical chart:



Now imagine that increased production requires an overall increase in the size of the division, although its functions do not change. Obviously, the greatest change in size would be in the number of persons under a front-line supervisor. There should be little need for increases in personnel elsewhere except to accomodate the increased need for organizational support services for the greater numbers of lowest-level workers. The following chart depicts the larger division:



1) Construct a new table (call it Table 15.1) to reflect this interpretation of Table 15.

Table 15.1

2) In what ways does Table 15.1 differ from Table 15? (compare the tables with respect to the questions of Section III-A).

III-C The discussion of Table 15 in the text deals with increases in span of control as organizational size increases. A positive correlation between size and span of control indicates that the greater the size of an organization, the greater the span of control of its divisions. Table 15, however, shows three positive correlations of different magnitude. How can one interpret the findings?

First, what is meant by span of control? Blau and Schoenherr define span of control as "the number of subordinates who report to an individual supervisor." In the analysis reported here, reference is made to the division head's span of control, and the average spans of control of middle managers and first-line supervisors.

1) So Table 15 shows that the number of subordinates increases with size principally in the case of _____, to a lesser extent for _____, and hardly at all for _____.

The text suggests that these differences in relationships can be explained by the fact that division heads need only a limited amount of staff services; their need does not vary with size. Low-level supervisors, however, oversee

2) What has happened to span of control in this division as a result of the changes in size? Fill in the following table to make your comparisons:

Table 15.2 Division Changes for Increased Production

	Before	After
Size	84	
Division Head's Span of Control	4	
Average Middle Manager Span of Control	3.7	
Average First-line Supervisor Span of Control	8.5	

3) You can satisfy yourself that the change in span of control is proportionately greater for lower managerial levels by computing the ratio of spans after to before. For the division head the ratio is 1.25. Find the ratio for the other managerial levels:

	Ratio of Span of Control After to Before
Division Head	1.25
Middle Managers	
First-line Supervisors	

4) The above interpretation has assumed unchanging functions. What if an increase in size is accompanied by greater heterogeneity in functions? What can you say about the relationship between size and span of control at different managerial levels?

III-D Gerald Bell has studied the relationship between span of control and three of its possible determinants in a small community hospital. He wanted to discover whether or not span of control is associated with any of the following:

subordinates' task complexity

closeness of supervision (see text pp. 44-45)

supervisor's task complexity

Data on 30 departments were obtained from 186 employees. Span of control was simply a count of the subordinates immediately below a given supervisor; the score for each department was the average of its super-

visors' spans. An index of task complexity for subordinates and supervisors was constructed from four variates (each of which was previously constructed from questionnaire or interview responses) - degree of predictability of work demands, amount of discretion they exercise, extent of responsibility they have, and the number of different tasks they perform. Closeness of supervision was an index based on two questions about supervisors' checks of and influence on a subordinate's work.

Bell presented his findings in the following three tables:

Subordinates' Task Complexity

Span of Control	Low	Medium	High
Low	1	1	6
Medium	5	5	2
High	5	4	1
	11	10	9

Supervisor's Task Complexity

Span of Control	Low	Medium	High
Low	1	0	7
Medium	4	4	4
High	5	2	3
	10	6	14

Closeness of Supervision

Span of Control	High	Medium	Low
Low	3	2	3
Medium	1	5	6
High	3	3	4
	7	10	13

1) What are the units of these tables?

2) What was the source of the data for the tables?

3) How many variates make up each table?

4) Which of the variates would you consider a simple element (or indicator) and which are indices?

5) How many points in time are represented by the data in the tables?

6) What is the nature of the numbers displayed in the tables (are they raw data, percentages, scale scores, or what)?

7) Describe the dependence relation or causal structure of the variates in each table. Are any variates assumed to be causing others? (if yes) Which one(s)? Which variate is dependent? Are any of the variates stratifiers? (if yes) Which one(s)?

8) What percentage of the departments had high average spans of control?

9) How many of the departments had both low subordinate task complexity and low span of control?

10) What percentage of the departments had both low span of control and high supervisor task complexity?

11) How many departments had neither high span of control nor low closeness of supervision?

12) What percentage of departments with high spans of control had high subordinate task complexity?

13) What percentage of the departments with either medium or low supervisor task complexity had high spans of control?

14) Given Bell's interest in the variates as described above, what can he conclude from the three tables? (State the principal finding from each table, then state your general conclusion).

Exercise IV

Thus far you have been examining and interpreting the variates of other researchers. Hopefully you have gained some degree of critical awareness of the strengths and weaknesses of their efforts. At this point we shall review the steps taken in forming variates. Now it is your turn to consider how to construct a variate from scratch.

IV-A Suppose you want to describe a set of universities in terms of the quality of their graduate psychology programs. What are some of the ways in which you could determine "quality"? Let us proceed in accordance with the phases of

variate formation discussed in the text.

1) Imagery - What kind of imagery is evoked in your mind by the notion of quality in a graduate program? For the moment, just think about what the concept of "quality" means to you. What accounts for quality? What inputs into a graduate program and what aspects of the program itself might contribute to its quality? What are the consequences of a program's quality on its outputs?

2) Concept Specification - Now try to make your thoughts on this problem somewhat more concrete by determining the specific conceptual dimensions of the concept. For example, quality is essentially subjective in that it involves valuation, but it may be viewed as having both social and individual aspects. On the other hand, quality may describe socially desirable factors as determined by group preferences; on the other hand, to an individual, quality may be determined by personal preferences consistent with his unique interests. Within each of these dimensions we might consider a further breakdown into the quality of specific program dimensions. A program can be evaluated on the basis of its structure, or on the basis of its outputs (graduates). Obviously each of these might be further subdivided; for example, faculty quality could be based on teaching ability or on a broader professional contribution (publications). What dimensions underly your concept of "quality"?

3) Selection of Indicators - Now try to make your specification of quality entirely concrete. What empirical indicators would you use to measure each of the above dimensions? You must be very specific. For example, faculty quality as indicated by publications could be a simple count of all publications (including books, monographs, papers, book reviews, etc.) or it could consider the types of publications, in which case each type must be counted separately. But a different approach might be required in developing an indicator of teaching quality. Teaching could be indicated by faculty peers' judgments or by students' evaluations. Either case would involve asking others to give their subjective rating directly. What indicators are required for your conceptualization of the quality dimensions?

4) Formation of Variates - Any of the above indicators can be taken as a variate if it is to be used in an analysis. But generally one will have to do some form of combining operation to arrive at analytic variates. In the example of faculty publications one may have decided to construct a publications variate by combining the types under a differential weighting scheme (e.g., 1 book might have the value of 6 papers). Or if student evaluations are used to measure teaching quality, the individual evaluation must be combined to form a single variate for each teacher's quality. However, since we are ultimately interested in an indicator of teaching quality of the department as a whole, and then in an even more general variate of program quality, it will be necessary to combine several levels of variates into higher level variates or indices which will culminate in a single number to stand for the quality of each program. Do you have any ideas as to how you might do this for your indicators?

IV-B Let us examine an actual study dealing with measures of graduate program quality. It happens that much of the complexity suggested by the levels of indicators considered above has been simplified in this study by using the impressions of professional peers as surrogates for the evaluations and combinations of detailed indicators. In short, one way of determining the quality of a program is to ask qualified judges to rate it. The judges' ratings can then be combined into a single measure of quality. This procedure was followed by the Commission of Plans and Objectives for Higher Education of the American Council on Education in 1964. In this study the judges were faculty members classified as junior scholars, Senior scholars, or chairmen of a department within the academic field which they were asked to rate.

The judges responded to two different questions indicating graduate program quality:

> Which of the terms below best describes your judgment of the quality of the graduate faculty in your field at each of the institutions listed? Consider only the scholarly competence and achievements of the present faculty.
>
> 1. Distinguished
> 2. Strong
> 3. Good
> 4. Adequate
> 5. Marginal
> 6. Not sufficient to provide acceptable doctoral training
> 7. Insufficient information
>
> How would you rate the institutions below if you were selecting a graduate school to work for a doctorate in your field today? Take into account the accessibility of faculty and their scholarly competence, curricula, educational and research facilities, the quality of graduate students and other factors which contribute tothe effectiveness of the doctoral program.
>
> 1. Extremely attractive
> 2. Attractive
> 3. Acceptable
> 4. Not attractive
> 5. Insufficient information

A total of 198 psychologists from 106 universities rated graduate psychology programs at 106 universities. The mean response to each of the above questions for each graduate program was used as the variate describing either faculty

quality or effectiveness. The list of departments receiving an overall rating above 3.00 on faculty quality and 1.50 on effectiveness is reproduced below:

University	Rated Quality of Graduate Faculty	Rated Effectiveness of Graduate Program
Berkeley	4.35	2.23
Brown	3.73	1.97
Chicago	3.37	1.60
Columbia	3.54	1.63
Cornell	3.33	1.57
Duke	3.34	1.61
Harvard	4.58	2.35
Illinois	4.08	2.14
Indiana	3.62	1.87
Iowa (Iowa City)	3.66	1.67
Johns Hopkins	3.44	1.79
Michigan	4.40	2.36
Minnesota	3.98	2.06
Northwestern	3.43	1.78
Pennsylvania	3.63	1.86
Stanford	4.56	2.58
UCLA	3.58	1.78
Wisconsin	3.97	2.08
Yale	4.35	2.34

1) What are the units of this table?

2) What was the source of the data for this table? (refer to introduction)

3) How many variates make up the table?

4) Which of the variates would you consider a simple element (or indicator) and which are indices?

5) What is the nature of the numbers displayed in the table (are they raw data, percentages, scale scores, or what)?

6) Describe the dependence relation or causal structure of the variates in the table. Are any variates assumed to be causing others? (if yes) Which one(s)? Which variate is dependent? Are any of the variates stratifiers? (if yes) Which one(s)?

7) Classify each university under a two-part scheme for each variate as follows:

Rated Quality of Graduate Faculty	
Outstanding	3.70-5.00
Very Good	less than 3

Rated Effectiveness of Graduate Program

Outstanding	2.00-3.00
Very Good	less than 2.00

8) Using this scheme, describe quantitatively the relationship between rated faculty quality and rated program effectiveness. (Construct a table of raw data showing effectiveness by faculty quality).

9) On the basis of your table, what can you say about the relationship between the variates?

10) If you needed an indicator of graduate program quality and both of these were available, which would you use?

Segregation Indices

The unit that follows in intended to demonstrate some of the complexity involved in constructing an index for a qualitatively complex phenomenon. Accordingly, you will find that the material requires a more concentrated effort than preceding exercises. If you follow the discussion carefully, however, you should discover that what initially appears mathematically formidable in fact reduces to elementary arithmetic. Even if you never have to build an index yourself, mastery of this unit will prepare you to analyze critically almost any index you may encounter in the literature.

Segregation Indices

One of the significant demands made on quantification is to provide measures of social phenomena for which reasonably sensitive summary indicators may be needed to shape policy. Segregation is such a phenomenon. It is often perfectly obvious, qualitatively, that segregation exists, but differences in degrees of segregation may be either unnoticed or difficult to describe. For example, a common practice for masking discriminatory employment practices is to fill low-level positions with minority group members, to maintain segregated managerial positions, and then, on the basis of the overall percentage of minority group employees, to claim non-discriminatroy employment practices. An index of segregation across occupational categories should disclose the real story and would be most useful when such practices are subtle.

Thinking of segregation as some measure of the evenness of a frequency distribution, it seems simple enough to construct an index based on deviations from evenness. For example, an even distribution would appear as in Figure __.1a__ in contrast to the uneven distribution of Figure __.1b__.

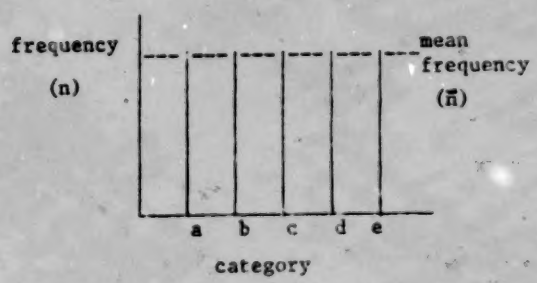


Figure __.1a__

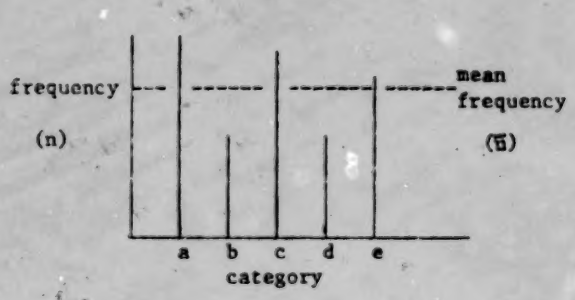


Figure __.1b__

The mean of the category frequencies is the value each category is expected to have if the distribution were even. Given this reasoning, one might measure evenness as some function of a summated index of the deviations from that average. The mean deviation (V) is a good candidate:

$$V = \frac{\sum_{i=1}^{k} |n_i - \bar{n}|}{k},$$

where:

k is the total number of categories
n_i is the frequency of units in the i^{th} category
$\bar{n}$ is the mean frequency
$|n_i - \bar{n}|$ is the absolute value of the difference between n_i and $\bar{n}$, i.e., the positive value of the difference.
$\sum_{i=1}^{k} |n_i - \bar{n}|$ is the sum of all deviations from the mean.

But would this be satisfactory?

Suppose we are concerned with the distribution of 90 blacks in six equal-sized departments of an organization. If they are not segregated, we expect them to be evenly distributed, i.e., there should be fifteen blacks in each department. Figure .2 shows two possible empirical distributions:

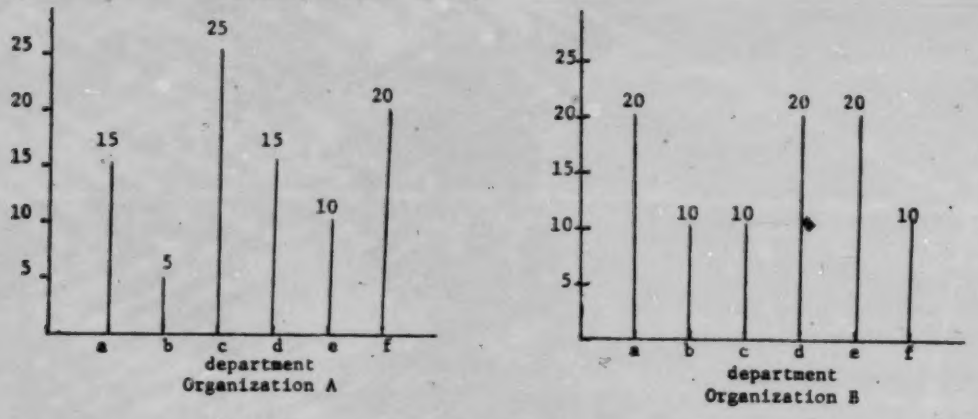


Figure .2

1) (a) Which distribution is more segregated?

(b) For Organization A, $V_A = 5.0$. Compute V_B (V for Organization B).

(c) Are the indices, V_A and V_B, consistent with your response to a)?

While there may be some ambiguity, intuitively, in determining which distribution shows more segregation, the blacks seem to be more unevenly distributed, and thus segregated, under Organization A. Yet upon computing V for each distribution, we find they are equal ($V_A = V_B = 5.0$)--a counter-intuitive result. On its face validity, V is unsatisfactory. The differences can be made clearer by arranging the departments in ascending order by frequencies, as in Figure .3.

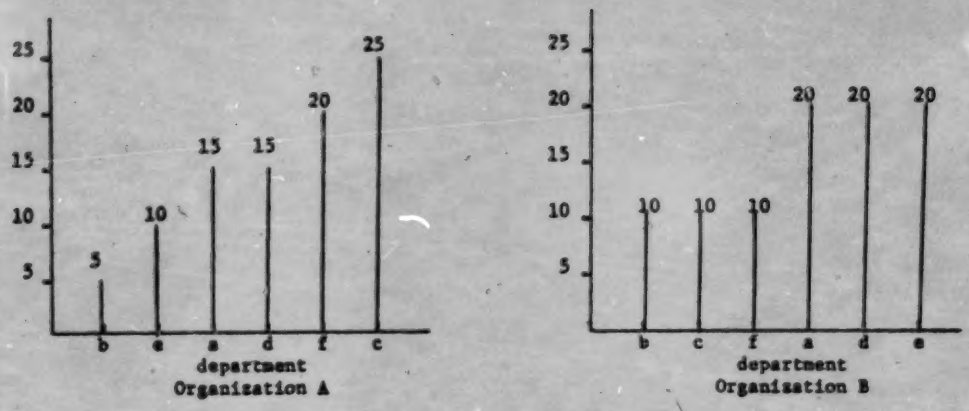


Figure .3

The trouble with V is that it uses an arbitrary referent (in this case the mean) in determining the spread of the units, rather than the "intrinsic spread". The factor that seems to shape our intuition is the difference between pairs of category frequencies, especially between the extreme values. In Organization A, for example, it is striking that the difference in size between categories in which blacks are most and least concentrated is 20, in contrast to 10 for Organization B. As an alternative to V, we want a measure based on pairwise differences, in keeping with our intuitions. One well-known measure, the Gini index, fulfills this requirement.

The Gini index (G) is a coefficient of concentration intended to indicate the evenness of a distribution of attributes. It does so by determining the average of the pairwise differences in category frequencies and then dividing that average by the maximum value it could attain--the mean difference computed under the condition of maximum concentration (all units falling under one category).

The first step in constructing the index is to compute the difference between all possible pairs of category frequencies, $n_j - n_i$ (the difference between the frequencies in categories i and j). Recall that matrices are often useful in working with pairs. In this case, if you cross-classify all

the categories, you can construct a matrix whose cells contain the difference between frequencies from corresponding row and column categories. Table 1 does this for a general case with six categories; Table 2 gives the actual differences for the ten categories of Organization B.

Table .1 A General Matrix of Pairwise Differences Between Category Frequencies

	Category: 1 (n_1)	2 (n_2)	3 (n_3)	4 (n_4)	5 (n_5)	6 (n_6)
1	0	n_2-n_1	n_3-n_1	n_4-n_1	n_5-n_1	n_6-n_1
2	n_1-n_2	0	n_3-n_2	n_4-n_2	n_5-n_2	n_6-n_2
3	n_1-n_3	n_2-n_3	0	n_4-n_3	n_5-n_3	n_6-n_3
4	n_1-n_4	n_2-n_4	n_3-n_4	0	n_5-n_4	n_6-n_4
5	n_1-n_5	n_2-n_5	n_3-n_5	n_4-n_5	0	n_6-n_5
6	n_1-n_6	n_2-n_6	n_3-n_6	n_4-n_6	n_5-n_6	0

Table .2 Pairwise Differences in Frequencies for Organization B

	Department a (20)	b (10)	c (10)	d (20)	e (20)	f (10)
a	0	-10	-10	0	0	-10
b	10	0	0	10	10	0
c	10	0	0	10	10	0
d	0	-10	-10	0	0	-10
e	0	10	10	0	0	10
f	-10	0	0	-10	-10	0

The average of all the differences, ignoring minus signs, is the average of the absolute values of the matrix cell entries. It is computed by summing all the differences and dividing by k(k - 1)--the total number of pairs, excluding those in which a category frequency is subtracted from itself. (Examine Tables .1 and .2 to be certain you understand this procedure.) Denoting the mean difference by 'Δ', we have

$$\Delta = \frac{\sum_{i=1}^{k} \sum_{j=1}^{k} |n_j - n_i|}{k(k-1)}$$

For distribution B, $\Delta = 6.00$ (Verify this for yourself).

The next step in computing G is to divide Δ by the value it would have under maximal concentration. It can be shown that maxΔ is simply two times the mean of the category frequencies, i.e., $2\bar{n}$. Thus,

$$G = \frac{\Delta}{2\bar{n}},$$

or since $\bar{n} = \frac{\sum_{i=1}^{k} n_i}{k}$ and letting $N = \sum_{i=1}^{k} n_i$ (the total number of units),

$$G = \frac{k\Delta}{2N} .$$

For Organization B, G = .20.

At this point we are equipped to compute G for any distribution. But instead of using the formula that defines G, we shall now derive a computing formula for G which is not only easier to calculate, but which uses adjacent pairs of an ordered distribution (such as may be computed from the frequencies in Figure ___.3)--a form more in keeping with our original observations about concentration.

To begin with, notice that the formula for Δ double-counts differences (each pairwise difference is represented twice in the matrix, once as $n_i - n_j$ and once as $n_j - n_i$, as can be seen in Table ___.1); it suffices to count each difference once. Secondly, notice that if the categories for the rows and columns of a difference matrix are arranged from low to high according to their frequencies, the matrix entries will be organized such that all the numbers above the main diagonal are non-negative, and all those below are non-positive (this is done for Organization B in Table ___.3_).

Table ___.3 Ordered Pairwise Differences for Organization B

	b n_1 (10)	c n_2 (10)	f n_3 (10)	a n_4 (20)	d n_5 (20)	e n_6 (20)
b	0	0	0	10	10	10
c	0	0	0	10	10	10
f	0	0	0	10	10	10
a	-10	-10	-10	0	0	0
d	-10	-10	-10	0	0	0
e	-10	-10	-10	0	0	0

Finally, as evident in Table 4, the difference between any non-adjacent pair can be represented as the sum of differences of adjacent pairs. For example, the difference $n_5 - n_2$ is equal to $(n_5 - n_4) + (n_4 - n_3) + (n_3 - n_2)$ (the matrix entry at the intersection of the fifth column and the second row).

Now study Table .4. With the categories arranged in order from 1 to k, such that the frequency of any category will be greater than or equal to any of the ones preceding it ($n_i \leq n_{i+1}$), the difference between any adjacent pair ($n_{i+1} - n_i$) will occur $i(k - i)$ times. You can verify this from Table .4 by picking any adjacent pair difference ($n_{i+1} - n_i$) and counting how many times it appears in the matrix. But more simply, the difference between any adjacent pair (i,i+1) appears at the intersection of row i and column i+1 and will appear with sums of other differences in every cell above and to the right of that position. Table .5 makes this clear. You can see that, taken together, the cells in which an adjacent pair $n_{i+1} - n_i$ occurs form a rectangle with dimensions $i \times (k - i)$. Accordingly, $n_{i+1} - n_i$ occurs $i(k - i)$ times. This is particularly obvious for our hypothetical organization B. Only the difference between departments a and f is not equal to zero ($n_4 - n_3 = 10$); as a result, all entries above the main diagonal (and forming a 3 x 3 square) are occurences of $n_4 - n_3$ (See Table .3). The sum over all occurences of adjacent pairs, call it S, is

$$S = \sum_{i=1}^{k-1} i(k - i)(n_{i+1} - n_i),$$

and

$$\Delta = \frac{S}{\frac{1}{3}k(k-1)}$$

S is essentially a weighted index of differences between adjacent categories. It is really quite simple to compute under the following procedures:

i. Arrange categories in order from low to high by frequencies.
ii. For each pair (i,i+1) determine the number of categories below and including the i^{th} and the number above the i^{th}; then multiply these values: $i(k-i)$.

iii. Subtract the frequency of the i^{th} category, n_i, from n_{i+1} and multiply the difference by $i(k-i)$.
iv. Add up all the values thus calculated.

Table 4 A Matrix of Pairwise Differences Between Six Category Frequencies

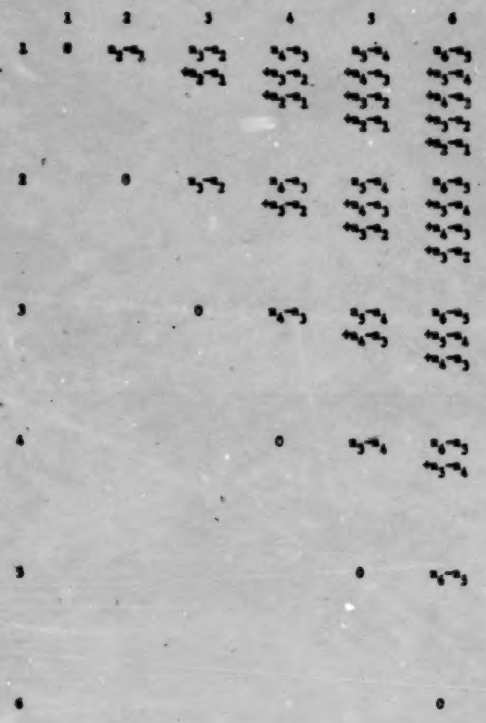
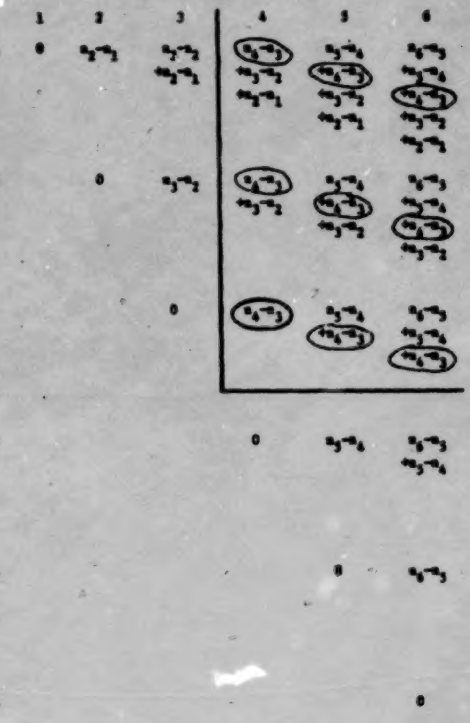


Table 5 A Matrix of Pairwise Differences Showing Occurences of $n_4 - n_3$



For Organization B, S may be calculated as follows:

category	n_i	i	x	k-i (k=6)	x $n_{i+1}-n_i$	= $i(k-i)(n_{i+1}-n_i)$
b	10	1		5	0	0
c	10	2		4	0	0
f	10	3		3	10	90
a	20	4		2	0	0
d	20	5		1	0	0
e	20	6		0		
		$\overline{N = 90}$				$S = \overline{90}$

Substituting Δ in the formula for G, we have

$$G = \frac{S}{k(k-1)\bar{n}}$$

$$= \frac{S}{(k-1)N}$$

Then, for Distribution B we have,

$$G_B = \frac{90}{5 \cdot 90}$$

$$= .2 \text{ (as before).}$$

2) Compute G for Organization A.

3) Are blacks more or less segregated in Organization A than in Organization B?

Thus far, we have measured segregation without regard for the total size of each category. If you wish to describe segregation by percentage representation--not mere concentration--you simply use percentages of minority members in each category as input data for n_i. To illustrate, until now we have not been concerned with the total size of any departments in our hypothetical organizations, because we have assumed equal category sizes. The value of G should be different if the categories are not the same size. Suppose Organization B has a grand total of 450 employees and that each department with 10 blacks has a total of 50 employees and each with 20 blacks has a total of 100 employees. Then all departments have equal percentages (20%) of blacks and G equals zero.

Be certain to remember that, in using percentages rather than raw frequencies to compute G, the categories must be ordered from low to high on the basis of the percentages, not on the original frequencies. Also, the term N in the formula for G is no longer the total number of minority members; rather it is the sum of the category percentages ($N = \Sigma n_i$, where n_i is the percentage of minorities in the i^{th} category). Let us calculate G to show segregation by percentage representation for the blacks in Organization A. Assume the following data for this problem:

	department					
	a	b	c	d	e	f
number of black employees:	15	5	25	15	10	20
total employees:	50	100	50	100	100	50

Using these data, we can compute the percentages of blacks in each department:

	department					
	a	b	c	d	e	f
percentage black employees:	30.0	5.0	50.0	15.0	10.0	40.0

Arranging the categories by percentages, we can proceed to calculate G_A:

category	n_i	i	x	$k-i$	x	$n_{i+1}-n_i$	=	$i(k-i)(n_{i+1}-n_i)$
b	5.0	1		5		5.0		25.0
e	10.0	2		4		5.0		40.0
d	15.0	3		3		15.0		135.0
a	30.0	4		2		10.0		80.0
f	40.0	5		1		10.0		50.0
c	50.0	6		0				
	Σn_i = 150.0							S_A = 330.0

$$G_A = \frac{S_A}{(k-1)\Sigma n_i}$$

$$= \frac{330}{5 \cdot 150}$$

$$= .44$$

As you can see by comparing .44 with the value of G_A you computed earlier, the degree of segregation in Organization A would have been understated if the department sizes had not been taken into account.

4) Table .6 provides information about positions of men and women, by race, in the Pittsburgh school district for 1972 and 1973. Using this data, construct a table of segregation indices for the distribution of employees in occupation categories by race and sex for two years by filling in Table .7.

TABLE .6 SUMMARY OF EMPLOYEES IN SCHOOLS BY OCCUPATIONAL CATEGORIES

OCTOBER 1972

	White			Black			Grand
Professional Employees	Male	Female	Total	Male	Female	Total	Total
Teachers	972	1857	2829	115	401	516	3345
Principals, V/and Asst. Principals and Deans	81	24	105	37	19	56	161
Other Professional	76	48	124	9	30	39	163
Non-Professional							
Clerks	5	185	190	1	49	50	240
Aides/Team Mothers etc.	25	167	192	54	354	408	600
Custodial/Cafeteria	174	396	570	138	195	333	903

OCTOBER 1973

	White			Black			Grand
Professional Employees	Male	Female	Total	Male	Female	Total	Total
Teachers	1001	1711	2712	117	430	547	3259
Principals, V/and Asst. Principals and Deans	92	18	110	40	19	59	169
Other Professional	72	44	116	7	31	38	154
Non-Professional							
Clerks	5	197	202	1	43	44	246
Aides/Team Mothers etc.	20	166	186	32	341	373	559
Custodial/Cafeteria	178	353	531	138	197	335	866

Table .7 Segregation Indices for School Employees by Race and Sex for 1972-1973

1972

	Whites	Blacks	All
Males	.50	.54	.45
Females	.33	.37	
All	.16	.32	

1973

	Whites	Blacks	All
Males	.51	.57	.48
Females	.35	.38	.26
All	.16		

5) a) Which group of persons was most segregated in both 1972 and 1973?

   b) What accounts for their segregation? (In which occupational categories were they most and least concentrated?)

6) Assume that the differences between years indicate a trend in segregation. What is the nature of the change? (Is segregation increasing or decreasing?)

7) The segregation indices for males are higher than those for females, regardless of race. Would one be correct in stating that women are better off than men in the occupational structure of this school system? Discuss your answer in terms of the categories in which each is over-or-under-represented.

8) Ironically, the higher male segregation indices lend to the interpretation of the female segregation indices. How is this so?

9) Given your answers to the above questions, it may be that we are mistaken in interpreting the Gini coefficient of concentration as an index of segregation. What additional factor(s) should be accounted for by a segregation index?

Effectiveness Index

I. The measure of percentage difference (D) discussed earlier may be used as a summary index of change over time. Other measures are generally preferred, however, when one wants to demonstrate purposeful change, as, for example, in evaluating the effectiveness of teaching a group factual information. If success is measured in terms of the percentage of persons who have learned a fact relative to those who already knew the correct information, then D is unsatisfactory; it does not take into account the initial or baseline percentage of knowledgeable persons. A common alternative is to compute an index of percent improvement (call it E) by dividing D by the initial percentage, i.e., $E_1 = D/P_1 = (P_2-P_1)/P_1$. But as noted in the text, E_1, is subject to bias stemming from a ceiling effect. Hovland's effectiveness index ($E_2 = (P_2-P_1)/(100-P_1)$) was designed to be relatively less biased by the ceiling effect than is E_1.

A "ceiling" in this context is an upper bound on the numerical range of an index. The ceiling for percentage is 100%; thus, the higher the initial percentage, the less room there is for improvement. The ceiling effect is simply the limiting effect attributable to the ceiling.

The ceiling effect is implicated in all three indices (D, E_1, E_2). It affects values of D by limiting the change possible over initial percentages. For a given initial percentage, P_1, the maximum positive value of D is $100-P_1$. If P_1 is 70%, then D cannot be greater than 30 (the maximum value P_2 can assume is 100% and 100-70=30). If P_1 is 85%, then the maximum positive D is 15. It follows that both E_1 and E_2 are

constrained by the ceiling effect because each incorporates D. However, in E_1 the ceiling creates considerable bias against items with high initial percentages. If 80% is the initial percentage and 100% (the ceiling) is the final percentage, E_1 is only 25%, the same value as would have been found had the initial percentage been 16% and the final percentage been 20%. In contrast, E_2, which is also subject to the ceiling effect, is not biased to the same degree. For the examples just given, when P_1=80% and P_2=100%, E_2=100, i.e., there is 100% improvement over the initial percent wrong; when P_1=16% and P_2=20%, E_2=4.8--an indication of trivial improvement relative to the possible room for improvement.

Table 6 of the text demonstrated the differences among measures of effect for soldiers' responses to a factual question. The choice of an appropriate index of effect was complicated by differences in the respondents' abilities (as indicated by education level). Despite Hovland's argument for the statistical desirability of E_2, it seems unreasonable to use it as a basis for comparing the performance of groups with different abilities. We expect college men to perform well; indeed, one might even argue that they should have done better--that the overall improvement was not impressive. On the other hand, we expect men who did not finish high school to perform poorly relative to the college men; it is impressive that they did so well. Assuming greater difficulty in teaching persons with low education, E_1 more accurately reflects our feelings about their performance. E_2 yields figures more in line with expectations of learning ease. Thus, even though E_2 has

desirable statistical properties, its interpretation must be tempered by substantive considerations. In any event, one should be cautious in using any index as a basis for comparing groups which differ on some criterion implicated in the index.

Let us examine another table from Hovland's study in which ability is not controlled. Table .1 gives the percentages of exposed and control groups answering correctly on two different questions.

Table .1 Percent Answering Correctly on Two Items Explained in a Film

	Item A	Item B
Exposed Group	36%	5%
Control Group	55%	18%

1) Fill in the following table with appropriate indices of effect:

	Item A	Item B
D (percent difference)		
E_1 (percent improvement)		
E_2 (effectiveness)		

2) Discuss the differences among the index values with respect to the ceiling effect.

3) On which item do you believe there was most improvement? Substantiate your answer.

II. Attitude Conversion Under Crisis

In the Spring of 1969, a sizable group of Harvard students seized a university building and conducted a sit-in to protest events related to the Vietnam war and Harvard's military involvement. The demonstration was terminated seventeen hours later by police intervention resulting in some two hundred injuries.

Marshall Meyer (1971) conducted a survey of students in Harvard College, Radcliffe, and the Graduate School of Arts and Sciences three weeks after the sit-in to ascertain their general political opinions and their specific attitudes toward the campus events. Among the questionnaire items were retrospective questions paired with those on current opinions. These enabled analysis of the data as if they were from a panel study. Meyer used these items to examine how events subsequent to the building seizure (in particular, the police bust) effected change in attitudes toward the seizure and sit-in. His general findings are presented in Table .1.

Table .1 Current and Retrospective Attitudes of Harvard Students Toward Campus Events, as Measured in May, 1969.

Items:	
Percent who <u>now</u> think that takeover of building was justified	30%
Percent who <u>had</u> thought takeover justified	16%
(base N)	(913)
Percent who <u>now</u> think there should be no penalty for students occupying University Hall	18%
Percent who <u>had</u> thought there should be no penalty	8%
(base N)	(913)
Percent who <u>now</u> approve calling the police	28%
Percent who <u>had</u> thought it advisable to call the police	20%
(base N)	(867)

1) On which of the three attitudes did campus events have the greatest impact? Cite relevant indices in your answer and justify their use.

Meyer described the attitude changes as "conversions" and measured the shifts in terms of a conversion rate which is the same as the effectiveness index described above. He interpreted the index as the probability that an individual who initially held an attitude would have changed his position by the time the questionnaire was administered. One of the surprising findings was that the percentage of students who approved calling the police increased after the fact. Apparently as some students became more sympathetic to the militants during the crisis, some also came to view police intervention as necessary—either because crisis "dissonances were resolved by finding...the police bust palatable," as suggested by Meyer, or perhaps because they found the bust to have functioned to the advantage of the militant cause.

It happens that most of the students surveyed described themselves as slightly left of center politically. One might wonder, as did Meyer, how changes in attitudes were related to political views, i.e., who reacted most to the seizure and police bust? Table .2 gives relevant data.

Table .2 Current and Retrospective Attitudes of Harvard Students Toward Campus Events by Political Position.

		Political Position			
		Far Left	Moderately Left	Just Left of Center	Center to Far Right
Items:					
Takeover justified:	current	65%	33%	21%	8%
	before	46%	14%	9%	3%
		(182)	(285)	(214)	(232)
No penalty:	current	47%	19%	8%	5%
	before	23%	8%	2%	0%
		(182)	(285)	(214)	(232)
Approve police:	current	3%	14%	33%	63%
	before	2%	11%	19%	47%
		(175)	(278)	(210)	(204)

Answer the following questions on Table .2 using indices relevant to your argument.

2) For both current and previous attitudes, describe the relationship between Political Position and
a) the belief that the takeover was justified.

b) the feeling that the demonstrators should not be penalized.

c) approval of the police intervention.

3) Describe the relationship between Political Position and change in
a) the belief that the takeover was justified.

b) the feeling that the demonstrators should not be penalized.

c) approval of the police intervention.

4) Justify or refute the hypothesis that the students approved the police bust because it functioned to the advantage of the militant cause.

Reason Analysis: An Expository Review

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141

Introduction

Reason analysis is a method for discovering and evaluating the causes of individuals' dispositions and behavior. It systematizes common, but often less than rigorous, procedures used in any research activity. The central features of reason analysis are the construction of an accounting scheme and the in-depth probing for reasons why a person engaged in the actions under study. Its purpose, ultimately, is to assess causes while distinquishing among actors on the basis of how they came to engage in the focal act. Variations of the method apply to situations where an individual did not do something expected and to events for which cause is to be assessed without interrogating the actor.[1]

Reason analysis may be applied to a wide range of individuals' acts. It is most effective in discerning subjective factors underlying purposive actions, such as those involving the intentional choice of a course of action. It has been found to be particularly useful, therefore, in market research and migration studies. As Kadushin suggests, it "is the method to be preferred if one or more of the following conditions hold true: a process is being studied; the act is extremely frequent or extremely infrequent; only those performing the act can conveniently be located or followed." (1968, p. 338). The first and last points are obvious. The second refers to cases where the gross differences in the number of actors and non-actors would render findings from typical cross-sectional analyses insignificant. In short, it applies to those

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[1] The latter variation is discussed in Zeisel (1968) under the label "reason assessment". The method will not be covered here although certain examples will be taken from reason assessments.

situations where "why?" can meaningfully be asked of an individual's action.

Reason analysis has been used to study a wide variety of human actions although it is particularly applicable to those involving a purposeful choice among alternatives influencing behavior. Typical applications of reason analysis have included consumer behavior (Kornhauser & Lazarsfeld, 1935; Smith & Suchman, 1940; Lazarsfeld, 1941; Katz & Lazarsfeld, 1955); migration (Mills, et al., 1950; Rossi, 1955a; 1955b; Ritterband, 1969); occupational choice (Lazarsfeld, 1929); voting (Gaudet, 1955); delinquency (Burt, 1925); marriage and divorce (Goode, 1956); participation in a voluntary association (Sills, 1957); and undergoing psychoanalysis (Kadushin, 1958). The principal references on the method of reason analysis are Zeisel (1968) and Kadushin (1968).

Reason analysis differs from other types of survey research in several aspects. First, while most cross-sectional analyses seek to explain an action by studying both actors and non-actors, reason analysis concentrates only on those persons who have performed the action. Thus the subjects in reason analyses are homogeneous with respect to the action under study. The procedure seeks to distinguish among them according to the various paths which led them to the same act.

Second, theory plays a greater role in reason analysis than is necessary in typical survey research. Reason analysis relies on an explicit action paradigm to form accounting schemes used to guide inquiries into reasons for an act. An accounting scheme is a classification of reasons under analytic categories dictated by an action paradigm and

and intended for use in specifying the causes of individual's acts. It is central to the conduct of reason analysis. Finally, reason analysis does not employ usual statistical methods for determining causality. Instead, causality is assessed through the careful probing of each individual's stated reasons for his actions. Such probing occurs at the data-gathering stage, not after, as in most survey analyses.

In seeking to assess the relative importance of reasons cited by respondents, reason analysis goes beyond the simple listing of reasons given. The point of reason analysis is to make sense of such reasons and, in so doing, to strengthen one's confidence in causal inferences drawn from the reasons. For example, in an inquiry on why youths drink, a sample of 383 junior and senior high school students who drank were asked to indicate why they continued to drink after their first experience (MacKay, et al., 1967). Their reasons are listed in Table 1. It was found that the most common reason (given by 38% of the students) was that they liked the taste; but is this sufficient to conclude that it is the most important reason? Clearly not; it merely stands as a frequently cited reason. Any of the other reasons may be a far more

Table 1: Reasons for Student Drinking

Reason	%
Because of feeling sick	6.0
Because of feeling tired	5.3
To get along better with people	7.3
To help in meeting new situations	4.7
Because of feeling lonely	12.4
To get "high" or "tight"	7.3
To get drunk	4.9
To help to forget	7.7
Because of feeling angry	8.8
To feel better when sad	16.2
Because of the taste	38.4
Because my friends do	23.2

powerful determinant of drinking. In reason analysis, a list such as in Table 1 would be the starting point for an in-depth probe to ascertain the causal process culminating in a student's drinking.

History

The systematization of methods for ascertaining reasons is associated historically with the development of so-called action theories and an interest in explicating causes of individual actions. In particular, it was developed by Lazarsfeld as a natural outgrowth of his training under Charlotte Buhler and his early interest in applied psychology and market research. Charlotte Buhler and her husband, Karl, were identified with the Wurzburg school, a group of German psychologists with a common interest in the experimental study of action. Karl Buhler, in particular, is well known for his method of interrogating experimental subjects to relate, by introspection, the steps they went through to arrive at solutions to problems. The methodology associated with this approach has been summarized by Ach as follows:

a) It was definitely a matter of retrospection, not introspection; the subject reported his experiences after the completion of the act and did not try to observe himself while he performed the task.
b) The interviewer made maximum use of the time sequence character of the experience. Occasionally, the method of "fractionization" was used; this meant that in a series of interviews the interrogator singled out varying phases for emphasis, according to where clarification was needed.
c) An idea which we might call synthetic structure played a considerable role. It turned out that the experiences of a number of subjects would differ in detail but that certain broad features were common to all. The purpose of the interview, therefore, was a two-fold one; on the one hand, to bring out the broad common structure by cumulation from one interview to the next; on the other hand, to facilitate the discovery and reporting of specific individual reactions to be accounted for later by the interpretation of the analyst.

> d) As the studies went on, the purpose of the interviews was not to serve as a catch-all for whatever the subject might have experienced. Rather, the role and location of specific elements in the course of the experience was the main purpose, for example, to see at which point the determination through the task did and did not play a role.
> (cited by Lazarsfeld, 1972, pp. 76 - 77)

The influence of this tradition as it pertains to reason analysis is manifest in Lazarsfeld's "The Art of Asking Why" (1935), the first English presentation of the method of probing characterizing reason analysis. The more general interest in the analysis of action for applied psychology was expounded by Kornhauser and Lazarsfeld in "The Techniques of Market Research From the Standpoint of a Psychologist" (1935) wherein they proposed that the psychological analysis of action serves as a master technique -- one used to plan and organize research -- for market research. The all-important accounting scheme falls quite naturally between the "master technique" and the interrogation for reasons, and both of the papers mentioned above describe what was later to be called an "accounting scheme."

Most of the early studies based on the method of reason analysis dealt with consumer behavior (e.g., Kornhauser and Lazarsfeld, 1935) although it was never intended to be the exclusive property of market research. Indeed, Lazarsfeld, while at the Buhler Institute in Vienna, had used an accounting scheme to organize government data on occupational choice. His work was published in Jugend und Beruf (Youth and Occupation) (1931). Likewise, in an effort independent of the Vienna work, Cyril Burt, an English psychologist, applied a similar technique to the study of reasons for delinquency (1925). Subsequent uses of reason analysis broadened its application to areas cited earlier. The procedure is not in common

use today, although continuing interest in reason frequencies suggests a need for its revival. This point will be discussed in a later section of this paper.

Overview

The method of reason analysis proceeds under several reasonably distinct stages. First, the problem is formulated in a manner which will make explicit the types of action to be studied while limiting the scope of investigation to factors consistent with the purpose of the research. Second, an action paradigm is developed as an abstract representation of the focal act, its components, and its determinants. Third, an accounting scheme is constructed as a concrete realization of the action paradigm. The accounting scheme will further specify the scope of investigation while arranging relevant factors into operational catgegories. Fourth, a best method of interrogating for reasons is selected and applied to get necessary information as prescribed by the accounting scheme. Fifth, causality is assessed through the analysis of reasons cited as action determinants. Finally, findings are tabulated and presented as statistical results for the whole sample and its various sub-categories (cf. Kadushin, 1968; Zeisel, 1968; Lazarsfeld & Rosenberg, 1955).

Notice that some of the stages may overlap. Problem formulation is certainly structured by at least a vague theory of action. Also causal assessment is implicit in the probing characterisitics of reason interrogation. This should not be bothersome. Presenting reason analysis as a series of stages merely facilitates discussion.

The stages of reason analysis are evident in Rossi's study of why families move (1955a; 1955b). Residential mobility is particularly amenable to reason analysis because not only is it the culmination of a well-defined decision process, but both the structure of the decision and its importance make it relatively easy for movers to reconstruct influential factors by retrospection. Rossi designed his reasearch to study the reasons given by families for moving from one home to another. It focused on Philadelphia households which had moved within a five-year period up to 1950. His sample included families of various socio-economic statuses in a variety of housing accomodations.

Two findings from previous research were important in formulating Rossi's research: known reasons for people moving and a paradigm for migration. A nation-wide survey by Branch (1942) asked "Why did you happen to move?" and found a variety of possible reasons for moving worthy of deeper exploration. Noting ambiguities in the responses stemming from different interpretations of the question, Rossi organized the reasons with their percentages as shown in Table 2.

Table 2 - Answer Categories Classified by the Frame of Reference Employed by the Respondent

I.	Characteristics of the Former Home:*	
	A. Better quarters or better location (i.e., unsatisfactory former home)	18%
	C. More space required	13
	D. Rents too high or house too large	12
	F. (In part) House in need of repairs	3
	Not answered in terms of former home	54%
II.	Characteristics of New Home:	
	G. Closer to location where employed	10%
	B. To build or purchase home	16
	Not answered in terms of new home	74%

III.	Decision Is Not Respondent's:	
	E. House sold, repaired, renovated, occupied by owner	10%
	F. (In part) House burnt or torn down	3
	No information as to decision maker	87%
IV.	Changes in Housing Needs	
	H. Marriage	5%
	No information about changes in needs	95%

*Note that the categories included under I are not mutually exclusive. "Better quarters" might mean quarters which are lower in rent, larger or smaller in size, and so on. Hence many of the cases included in this general omnibus category might have been more properly placed in some of the more specific categories.

(Reproduced from Rossi, 1955a, p.459)

It is notable that large percentages of respondents did not answer under each category--evidence of the inadequacy of a general "Why?" question. However, as shown, the findings suggest both a framework for formulating the problem and a set of tentative factors to be investigated.

Second, drawing on a migration study by C. Wright Mills and others (1950), Rossi had available an action paradigm for the study of mobility postulating influences in terms of "pushes", and "pulls", and "information channels". This constituted the general structure for an accounting scheme.

The accounting scheme was developed under the migration paradigm and included specific causal factors suggested both in previous research and through exploratory interviewing. It had as its major elements the following:

A. Complaints: Unsatisfactory features of the previous dwellings which impelled the family to leave
B. Specifications: Attributes of a new home which the family was particularly desirous of obtaining
C. Attractions: Features of the new home which made that dwelling more desirable than other dwellings considered.
D. Information Sources: Means by which the new dwelling was brought to the family's attention

(Rossi, 1955b, p.128)

Focusing on complaints (the "pushes" of migration), we can see the detail incorporated in an accounting scheme. The push culminating in a move is a sequence of three basic stages:

> Stage 1: The household is satisfied with the old dwelling. There are no complaints held by the family about the home or its surrounding environment.
> Stage 2: Dissatisfaction is aroused. Something occurs to generate complaints. The family begins to have a desire to move.
> Stage 3: The desire to move crystallizes into definite plans for moving and the move itself occurs.
>
> (Rossi, 1955a, p.460)

According to Rossi, the Typical Move consists of all three stages. A Delayed Move includes stages 2 and 3 only--the family was never completely satisfied with their home. A Forced Move consists of stages 1 and 3--the move was impelled by reasons other than complaints (Rossi, 1955a, p.460). The accounting scheme of Figure 1 synthesizes the proposed causes for moving with the processual factors in detail suitable to guide subsequent interviewing.

Recall that the general "Why?" question did not elicit complete information. In contrast, interviewing under the accounting scheme of Figure 1 not only minimized non-responses but also enhanced the inquiry in at least three respects: it increased the detail of the responses; it made the interview reasonably precise yet efficient; it provided data in a manner suitable to causal assessment.

Interviews were structured to get data from every family under all of the categories relevant to their decision to move. First, each respondent was asked a "stimulus" question -- "What was it that made you think of moving out?" -- for the purpose of establishing the general context of subsequent questions, while stimulating recollection of the

Figure 1: Detail of an Accounting Scheme for "Pushes"

I. Changes Causing Complaints to Arise:
What brings about the transition between Stages 1 and 2? What makes a previously satisfied household become dissatisfied?

Changes might be classified along the following lines:
A. Changes in the Dwelling or its Environs:
e.g. apartment falling into disrepair, neighborhood deterioration, etc.
B. Changes in the Structure of the Family Producing Changes in Housing Needs:
e.g. change in family size, shifts in age and sex compositions, etc.
C. Changes in the Family's Values and Aspirations:
e.g. shifts in social status, shifts in housing values of family, etc.

II. Complaints:
What are the things about the dwelling or its surroundings with which the family is dissatisfied?
A. Dwelling Design Complaints:
e.g. amount of space, utilities, layout, etc.
B. Dwelling Environment Complaints:
e.g. social composition of neighborhood, physical structure of the neighborhood, etc.
C. Space-Time Relationships to Significant Locations:
e.g. access of employment, services, friends, etc.

III. Barriers:
Once dissatisfaction is present, what prevents the desire to move from being realized? Often families harbor complaints for long periods of time without attempting to move.

Barriers may be classified as follows:
A. Deficiencies in Resources:
e.g. insufficient income, etc.
B. Pre-occupation with other matters:
e.g. ill-health, conflicting demands on income, etc.
C. Lack of Knowledge Concerning Opportunities:
e.g. family may believe that no housing is available to it.
D. Adverse State of Housing Market:
e.g. no appropriate housing available to family.

IV. Precipitants:
There is usually some time period between the arousal of dissatisfaction and the move itself. What are the events which permit or facilitate the translation of a complaint into action?

Precipitants might be classified as follows:
A. Changes in Household Resources:
e.g. increase in income, etc.
B. Changes in Relative Importance of Housing:
e.g. with a family's rise in social status, a new residence might appear to be a more pressing need.
C. Change in the Housing Market:
e.g. more vacancies on the market.
D. Events forcing a Move:
e.g. destruction of dwelling unit, change in marital status, eviction, etc.

decision to move. Then, the respondent was asked "exposure" questions about complaints with his former home -- those specific things which made him dissatisfied. Finally, after ascertaining the various complaints, he was asked an "assessment" question -- which of the various reasons did he consider most important? The general purpose of interrogation was to obtain requisite data as specified by the accounting scheme, and for each reason cited, to get the respondent's assessment of its importance.

With the interviewing completed, Rossi had at hand each family's reasons for moving and subjective assessments of causality. He found that complaints fell into three types -- those concerning space, the neighborhood, and costs. The interview results, organized by complaint types are shown

in the first two columns of Table 3. Space complaints were mentioned most (64%) and cited as most important by 45% of the families. Costs

TABLE 3: ASSESSMENT RATINGS OF COMPLAINT TYPES

	Primary Complaints (Impact)	Total Coverage	Effectiveness
Space Complaints	45%	64%	.70
Neighborhood Complaints	14%	29%	.48
Costs Complaints	12%	32%	.38

complaints were mentioned more often than neighborhood complaints although the latter were generally felt to be more important.

As a measure of the apparent effectiveness of each factor in bringing about a move, Rossi used an index defined as the ratio of primary complaints to total coverage. The effectiveness of each complaint type, for the entire sample, is shown in the last column of Table 3. It can be seen that space was clearly the most influential factor. Complaints about the neighborhood and costs were much less frequently cited, but if implicated, neighborhood complaints were somewhat more influential than costs.

Using similar procedures to analyze the other stages in the decision to move, Rossi was able to describe factors determining the move for various family and housing conditions. In particular, he found the modal decision process to be as follows:

> The modal family left its old home voluntarily, impelled by a recent change in its size which had rendered the size of its former place inadequate to its new composition. In searching for a new place, it looked through newspapers and asked friends and relatives to apprise it of prospective vacancies. Typically, the new home was brought to its attention by the personal contacts it had employed.

Each of these points has bearing on the scope of the research, although the importance of the third point may not be immediately obvious. Suppose we were contracted by a board of education to study the reasons high school students drop out. If the board's purpose is to do what it can to prevent drop-outs, then our research would most likely concentrate on the "pushes" of leaving school, i.e., on the factors over which the board has some control. But had the same research been contracted by a state labor department for the purpose of creating advertisements to curtail drop-outs, then our emphasis might fall on the "pulls" of leaving school to learn what is attractive about dropping out.

Recall that Rossi saw as the purpose of his study the potential for "modification and control in the setting of housing policies" (1955b, p.128). Accordingly his design of an interviewing program was governed by a concern for data appropriate to that purpose, i.e., to ascertain the sources of attitudes which "could ... be modified in setting new policies in the construction of housing units" (1955b, p.128). Thus in formulating one's problem it is important to distinguish between acts which were not intentionally induced by an agent other than the actor and acts which were externally induced, the causal agent having nothing to do with non-performance of the act (Zeisel, 1968).

Careful problem formulation for reason analysis involves at least three main considerations: Is reason analysis the appropriate method? Is the emphasis of the analysis consistent with the purpose of the research? Are the principal factors to be analyzed bounded, i.e., are they within the scope of possible inquiry?

In the following example we see how a relatively innocuous research problem reveals its intricacies as one begins to analyze it.

Let us suppose we want to study the reasons narcotic addicts give for their use of heroin. As a first step we might clarify our intent. Are we interested in the causes of addiction? If so, we must note immediately some obvious factors beyond the scope of reason analysis. Narcotics usage is the principal cause of addiction, and once hooked, the addiction is the driving force of usage. Clearly reason analysis has nothing to offer from this perspective. We might, then, reformulate our problem in one of several ways. One could investigate why an addict does not kick his habit or one might restrict the inquiry to some aspect of usage less severely influenced by addiction. For example, what are the reasons for initial usage, say, up to the first time heroin was mainlined?

This question is amenable to analysis, but requires several further decisions. First, we must decide who should be studied. There may be good reasons, for example, to confine attention to a particular age group, realizing that different generations will have been differentially affected by social forces. More important, we must decide upon a particular type of user for study. The person who began habitual use of heroin after initial usage may be very different from one who inadvertently became addicted. And of course true addicts may be quite different from "weekend trippers" or the occasional "chipper." Second, having decided on a study population, we must decide whether or not there is need for placing greater emphasis on one factor over another. A number of different purposes and interests may guide the research. A government funding agency may be especially interested in multi-drug abuse as it pertains to the heroin

addict population. Then we might place our emphasis on the gratifications obtained, as reflected in other types of drugs used - the "pulls" of heroin usage. Or we may have a particular interest in the availability of heroin -- its difficulty to obtain -- as a factor in its usage. Or we may want to concentrate on background determinants of usage as an exploratory step to future analyses of those factors unique to addicts which led them to heroin while others did not. Or, finally, we may want a detailed analysis of the addict subculture to understand the social pressures -- the "pushes" -- affecting usage.

Action Paradigms

The key to eliciting reasons is for the researcher to understand fully the possible causal factors or chains of events influencing the action investigated. One cannot intelligently ask "why" without some idea as to how the answer should be interpreted or, for that matter, how to recognize an answer. Underlying the question is an assumed action paradigm by which empirical findings can be classified and ultimately explained. Action paradigms provide an abstract conceptual scheme within which the problem may be formulated and evaluated. An element of an action paradigm is any of the general categories of factors which are causally related to action.

The importance of action theory to reason analysis is twofold: first, an action paradigm guides the construction of accounting schemes by specifying the general categories of variates to be explored; second, the action paradigm also specifies the relationship among the variates

giving rise to an action, thus forming the principal basis for assessing causality. Unlike other forms of survey analysis, reason analysis does not rely on statistical methods to infer causality. Instead, it depends on the rigorous and complete prespecification of causal factors and their linking mechanisms as the basis for causal inference. As Kadushin warns, "reason analyses generally fail if they do not begin with a model of behavior that specifies all the relevant factors that might impel an action or prevent one" (1968, p.338).

An explicit action model is not essential to the conduct of reason analysis, but a reason analysis cannot be designed without at least an implicit action model from which an accounting scheme may be constructed. In Rossi's study we saw how the act of moving could be analyzed as a stepwise process consisting of pushes, pulls, and sources of information. More general social psychological action paradigms may be needed for less structured acts.

The action paradigm underlying a reason analysis may assume different forms according to one's intellectual bent and the purpose of the investigation. Parsons' theory of action, for example, is used by many sociologists in the articulation of their own conceptual schemes. Parsons' paradigm involves an actor acting within a situation with an orientation to the situation which is both motivational (related to need-gratification) and valuational (guided by commitments to particular standards) (Parsons & Shils, 1951, pp. 56-60). Bearing in mind the importance of action paradigms but recognizing that the choice of an action paradigm is dependent on one's research purpose, the selection criteria can vary accordingly. Tolman proposed an action paradigm which seems especially suited to general applications through selective use. He partitioned the elements of his

scheme into dependent, independent, and intervening variables. The dependent variables are the actions under study. The independent variables are the causal factors initiating the action and include (1) the stimulus situation, (2) states of drive arousal and/or drive satiation, and (3) individual-difference-producing variables. The intervening variables are "postulated explanatory entities conceived to be connected by one set of causal functions to the independent variables, on the one side, and by another set of functions to the dependent variable of behavior, on the other" (Tolman, 1951, p. 281).

Most action paradigms assume an actor with personal interests, needs, and values behaving within an environment which not only facilitates and constrains behavior but also stimulates the actor into action. Differences among paradigms arise in the typological distinctions made and the postulated mechanisms of action. Of interest here are the applications of action paradigms rather than their differences. The reader interested in the historical development of the study of action is referred to Lazarsfeld, 1972.

Kornhauser and Lazarsfeld (1935) have shown how a general action paradigm may be applied to the analysis of an individual's market behavior. Although primitive, their scheme reflects a general approach to the analysis of action, not unlike Tolman's. An action is determined by factors in both the individual and the circumstances of the situation in which he acts. For market behavior, the scheme may be depicted as in Figure 2. Individual factors include both motives and mechanisms. "Motives"

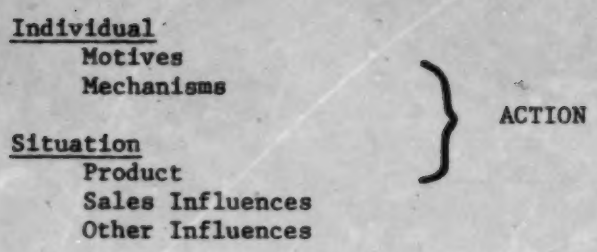

Figure 2: An Action Paradigm for Market Behavior

is here taken to mean that set of dispositions which might move an individual into action, e.g., needs, interests, or attitudes, conscious or unconscious, implicated in the action. The specifics need not be listed with the action paradigm but are considered in detail within a subsequent accounting scheme. The processes determining how motives operate are here called "mechanisms." These include personal sensory and motor capacities, intellectual skills, and knowledge. In short, those factors which activate and channel individual motives.

Factors external to the individual are no less important in determining action than internal factors. An individual's situation incorporates both facilitators and constraints guiding behavior. A person may purchase a product because of its having (or not having) certain attributes, because he has the money to afford it, because he has transportation to the store, because a friend recommended it, etc. In short, a person does not act in a vacuum. He is subject to an enormous number of situational influences, both positive and negative, bearing on his actions.

Thus far we have considered the elements of action as static factors. Action is by definition dynamic, generally consisting of many unit acts, each subject to the personal and situational factors discussed. More important to their causal assessment is the recognition that one action is usually the culmination of a string of prior acts, which, taken

together, constitute a causal string. Thus time is a natural component of action analysis. It enters action paradigms to place the central action in historical perspective. Kornhauser and Lazarsfeld sketched the entire process of making a purchase as in Figure 3. Beginning with

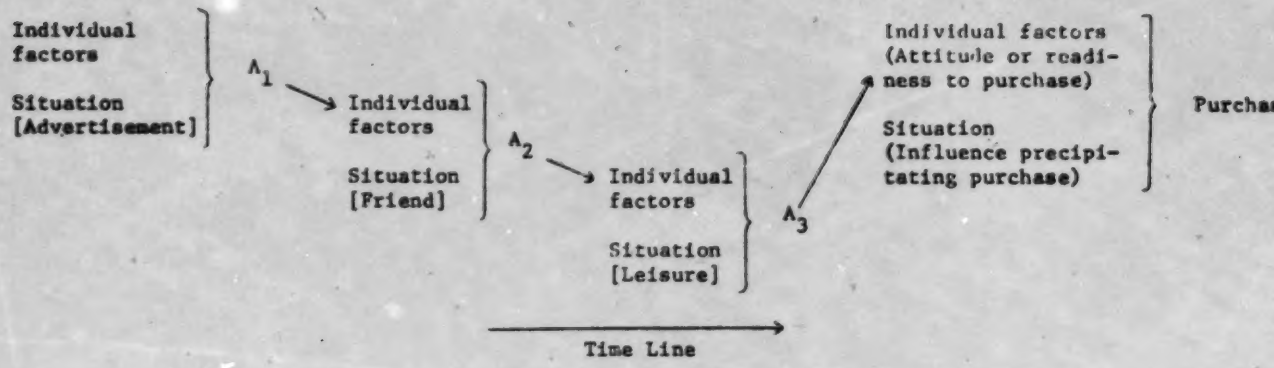

Figure 3: Processual Action Paradigm for Market Behavior

the individual at time 1 in a given situation he encounters an influence, say an advertisement, preceipitating a response - A_1. Action A_1 may be a favorable feeling toward some product. His new disposition becomes part of the set of individual factors which at a subsequent point are influenced by a friend's enthusiastic comments about the product resulting in A_2, say a distinct predisposition to buy it. Later, finding time to consider seriously buying the product A_3, he makes his decision and arrives at an attitude of readiness to purchase, which, subject to situational constraints, results in his making the purchase.

Most action paradigms are intended to explain unit acts rather than temporal sequences of unit acts culminating in some major act. One should remember that accounting schemes require considerable detail, generally including precise specification of time points. Any action paradigm can be made dynamic in the simple fashion exemplified by the Kornhauser and

Lazarsfeld model described above. However, such precision is less characteristic of action paradigms than of accounting schemes.

Accounting Schemes

Given tentative reasons and guided by an action paradigm, one may proceed to set forth, in detail, the specific factors causing an action, as they might be perceived by the actor. These are organized into an accounting scheme -- a concrete realization of an action model including the set of factors to be considered in subsequent interrogation of an actor and believed to be essential in accounting for his actions (Lazarsfeld and Rosenberg, 1955, p.388).

An accounting scheme classifies possible reasons for actions within dimensions logically determined by the action paradigm and refined substantively by the subjective content of the reasons themselves. It both limits the scope of investigation and facilitates analysis within the action paradigm by treating clusters of reasons as comparable under general categories. Different types of reasons are then amenable to statistical analysis and generalization beyond specific individuals.

The elements of accounting schemes are usually presented as explicit lists of reasons and/or their underlying factors. We have already seen how a scheme for complaints was used in Rossi's study of household moves. Zeisel has shown how an accounting scheme can be used to describe lawyers' decisions in choosing trial with or without a jury (1968, pp.162-164).

The decision to waive a jury trial in certain types of cases is governed by law office rules. The decision in other cases is a complex one involving several dimensions as shown in Figure 4. The reasons for waiving or not waiving the right to a jury trial may be understood by recognizing that there is a complex decision process underlying it. The scheme of reasons, in this example, is a list of relevant factors considered in that decision process.

I. Advantage Aimed At

- A. More advantageous verdict
- B. Costs of trial
- C. Better prospects for bargaining or an advantageous guilty plea
- D. Better opportunities for appeal
- E. Better insulation against client if case is lost

II. Influences on Decision

- A. Client's wishes
- B. Trial judge's preferences (to gain his favor)
- C. Counsel's personal preference
- D. Countering opposing counsel's preference
  - 1. In particular case
  - 2. In general
- E. Tradition in the particular court

III. Differences Between Judge and Jury Trial that can Produce the Advantage

- A. Jury
  - 1. More than one man
    - a. Composition can be modified through challenges before trial
    - b. To convince one single juror might suffice
    - c. Individual bias cancels out
    - d. No personal relationship to either side
  - 2. Basic attitudes
    - a. Not always bound by rules of law
    - b. Specific bias
      - (1) for underdog
      - (2) against unpopular indictment
      - (3) represent popular prejudice
    - c. Easier to influence
- B. Judge
  - 1. More lenient on penalty if jury waived
  - 2. Possibilities of personal bias
    - a. Re counsel
    - b. Re defendant or witnesses
    - c. Re type of case

IV. The Case

- A. Content of case
  - 1. Type of offense
  - 2. Is the primary issue a question of fact or of law?
  - 3. Defense effort concentrated primarily on question of
    - a. Guilt
    - b. Sentence
    - c. Major or lesser offense
- B. Expected length of trial
- C. Difficulty of case
- D. Personalities in case
  - 1. Client
    - a. Personal background
    - b. Physical characteristics
    - c. Manner of testifying
    - d. Past record
  - 2. Witnesses
    - a. Personal background
    - b. Physical characteristics
    - c. Manner of testifying
    - d. Past record
- E. Estimated odds of success (prior to trial)
- F. Public attention received by case

Figure 4: Scheme of Reasons for Choosing Trial With or Without Jury

Zeisel exemplifies the use of the scheme, from an attorney's perspective as follows:

> This was a case of a homosexual (IV-A-1); I was somewhat afraid of a jury, because they don't like sex deviates (III-2-b-3). Also I know the judge; he is an experienced

> wise man, not one of those hot-rods (III-B-2-c). There was anyway only a small chance of acquittal (IV-E); the big question was whether I could get a suspended sentence (IV-A-3-b), and I found that judges are more lenient on the sentence if they try the case without a jury (III-B-1). On the whole, I thought I would get my client a better verdict without a jury (I-A). I talked to my client about this decision, but he left it to me (II-A).
>
> (Zeisel, 1968, p.164)

There are no fixed rules for developing accounting schemes. One must be guided by the intrinsic structure of the action and his own analytic skills. Action paradigms facilitate the perception of structure and thus the identification of principal elements. Preliminary observation and interviewing are employed to gain an understanding of the action's unique substance. Recall how Rossi was able to organize Branch's data into general categories suggesting dimensions for an accounting scheme. In developing a scheme, a researcher tries to assemble as many possible reasons for an action as he can for the purpose of discovering broad categories suitable as analytic dimensions. The dimensions mark a logical framework for classifying all conceivable reasons.

Zeisel has exemplified how an accounting scheme was constructed for the reasons women use a particular face cream. Four of the typical reasons were as follows:

> Ms. A: I heard the cream advertised over the radio.
> Ms. B: I have very oily skin, and this cream is supposed to keep it dry.
> Ms. C: I have dry skin, and the druggist told me that this would keep it moist.
> Ms. D: It was supposed to have a pleasant smell.
>
> (Zeisel, 1968, pp.157-158)

As Zeisel points out, none of the women gives a complete story, and the various reasons cover several different dimensions. Ms. A simply gave a source of information. Ms. B cited a product trait associated with one of her personal traits. Ms. C implicated a personal trait, a product trait, and an information source. Ms. D gave a product trait. Thus there appear to be three categories of reasons:

1. Those referring to the respondent--special skin conditions or certain preferences of prejudices.
2. Those referring to the product--its qualities, its supposed effects, its price, and so on.
3. Those referring to the source--through which the respondent learned of the product or its qualities.

(Zeisel, 1968, p.158)

A complete response should include at least one reason under each general category. In this example, only Ms. C volunteered a complete reason for her purchase.

A simple accounting scheme with three dimensions - predisposition, qualities of the cream, and source of information - sufficed as a guide to obtaining complete answers in this purchase example. The dimensions correspond to an action paradigm involving the person, the object, and the social setting of the purchase (cf. Kornhauser and Lazarsfeld, 1935). Table 4 demonstrates how the scheme is used to locate missing information to be sought in subsequent interrogations for reasons.

Table 4: Subject Responses Classified by an Accounting Scheme

	Predisposition	Qualities of Cream	Information Source
Ms. A	-	-	Radio
Ms. B	Oily skin	keeps skin dry	-
Ms. C	Dry skin	prevents dry skin	Druggist
Ms. D	-	pleasant scent	-

(From Zeisel, 1968, p.158)

Reason Interrogation

Having developed an accounting scheme, the next major stage of reason analysis is to interrogate respondents to elicit their reasons for having acted. The accounting scheme is not, itself, a questionnaire. Effective reason interrogation is generally a flexible technique meant to avoid the rigidity of the accounting scheme. Reason interrogation is guided by several considerations. First, initial questions should allow a subject to answer freely according to his own frame of reference. This is generally done by asking a general "why?" question. But subsequent queries must be posed in such a way as to elicit answers consistent with the researcher's frame of reference, i.e., his accounting scheme. Second, the interrogation must be certain to cover all relevant elements of the scheme. Third, specifying and check questions should be introduced to facilitate the researcher's assessment of a subjects' reasons without relying exclusively on the respondent's assessments (Lazarsfeld and Rosenberg, 1955, pp. 388-389).

Three guidelines for formulating questionnaires are suggested by Lazarsfeld in "The Art of Asking Why" (1935). These are: (1) specification: ascertaining what a question means; (2) division: enabling the interviewee to answer; (3) tacit assumption: ascertaining what the answer means.

We have periodically alluded to problems with asking a general "Why?" question. We saw how Rossi's research went beyond the simple "why" of previous research to ascertain details which may not have been discovered otherwise. Effective reason interrogation is meant to get answers within the context of a respondent's subjective interpretation of the question. The complexity of "Why?" is readily demonstrated by example (Lazarsfeld,

1935): You have just purchased a book and I ask, "Why did you buy that book?" Your answer will depend on how you interpret my question. Consider the possibilities raised by simply emphasizing one word or another in the question:

Why did you buy <u>that</u> book (and not the other one)?

Why did you <u>buy</u> that book (instead of borrowing it from the library)?

Why did <u>you</u> buy that book (and not your classmate)?

The answer to this "why" question will vary according to a subject's interpretation of its meaning. If one expects to elicit a response in keeping with the purpose of his research, the "why" must be specified by questions indicating where the emphasis should lie.

Beyond insuring that the general "why" is interpreted in a manner suited to one's research purpose, interrogation must also be designed so that a respondent can answer in a meaningful way. This entails tailoring questions to each respondent's unique experience, thereby enabling him to answer with minimal incongruity with his personal frame of reference. Suppose that in the study of household mobility a family was found to have no complaints with their previous housing but had moved because of "pulls," e.g., having found a new job requiring relocation. It would be foolish to insist on eliciting complaints. At best respondents might emphasize trivial complaints to please the interviewer. At worst they might refuse to volunteer further information.

Finally, questionnaire construction should be guided by tacit assumption, i.e., by an awareness that a respondent's answers may have imbedded assumptions, presumed to be shared by both interrogator and respondent, which make answers meaningful. When Rossi studied housing complaints, a

family might have reported that they moved because of the size of their previous dwelling. How do we interpret such a response? A house that is too big for one family is too small for another. The answer conveys little information unless one knows something about the family's size and lifestyle. A growing family or one desirious of extravagent living may have need for a larger home. A family with older children leaving home may want a smaller house. What may be tacit assumptions in personal conversation have to be made explicit in reason analysis.

It is relatively straightforward to devise an interview schedule from an accounting scheme. But as noted above, the actual conduct of an interview is far more flexible than is suggested by an accounting scheme. In striving for flexibility it is essential that an interrogation be constrained by precise guidelines. These may be grouped according to those aiming for overall completeness and those dealing with causal assessment. The former are considered in the remainder of this section; the latter will be examined in the next section.

As part of a 1939 study on the effects of radio and political propaganda on change in political opinions, Hazel Gaudet (1955) prepared a guide for interviewers seeking data on changes in voting intention. The subjects had previously been interviewed and their political preferences were known. Her rules are directly descended from Lazarsfeld's guidelines and demonstrate an application to a substantive area other than market research. First, "wherever possible, the interviewer should limit the question to a particular area so the respondent will know more precisely what is expected of him"(1955, p. 429). Second, "responses should be supplemented by as much additional information

as the interviewer can possibly elicit from each respondent" (1955, p. 429). She proposed that the following three sets of items be elicited as a minimum account of change:

> (1) The answer must usually be stated in terms of the new choice. If the respondent has changed from a candidate or party to a state of uncertainty, however, a reason for change may be stated in terms of the old choice.
> (2) The answer must include the incident, occurrence or piece of new information which caused the change in opinion and, wherever possible, should indicate the source of this information. It is frequently possible to give the influence without being able to name the source definitely. The only cases in which the source of information might be given without a definite piece of information which changed the opinion would be in cases in which the prestige of the source of information was sufficient to change the respondent's mind no matter what the specific facts of the matter were.
> (3) The type of change should be specified; that is, the interviewer should find out whether this change occurred because of a new estimate of the candidate or party in question, or whether some fundamental principle of the respondent's has undergone change.
> A complete answer should always include a minimum of one element from each of these three groups, and usually should include more than that. It should tell who they are talking about, what information influenced them and if possible where they learned that piece of information, and finally how this influence changed their thinking.
>
> (Gaudet, 1955, p. 431)

To Gaudet's general rules we should add one on time. Many actions studied follow a sequence of smaller, unit acts whose timing is crucial to explaining the focal action. In particular, the influences of various factors on a sequence of acts cannot be understood without knowledge of their timing (Kadushin, 1968, p. 341). Interviewers should be certain to determine the timing of events and influences cited by respondents.

Finally, it should be noted that self-administered questionnaires may be used in place of interviews if done with care:

> Most reason analysis interviews skip about a good deal until all dimensions are revealed through probing. Thus experienced interviewers are usually necessary. On the other hand, if an act has been very carefully partitioned into units, elements, and factors; if pretests reveal a complete range of what respondents are likely to say; and if the respondents are sufficiently motivated to answer some open-ended questions, then it is possible to obtain from self-administered questionnaires results that are comparable to those obtained from interviews.
>
> (Kadushin, 1968, pp. 341-342)

Assessing Cause

Causal assessment involves first determining whether or not a given reason is in fact a cause of behavior and second, determining whether it is more or less influential on the action than other causes. Causality is not easily demonstrated under any kind of methodology. Reason analysis proceeds under the premise that the reasons given by respondents are legitimate indicators of cause, with certain reservations. Acts for which one cannot assume that an individual knows his reasons are beyond the scope of reason analysis.

Interrogation for reasons under the procedures described in the previous section is not sufficient to accept subjects' answers as the "true" reasons for their actions. The given reasons must be assessed for causality as specified by the accounting scheme and the internal consistency of each respondent's reasons. Such is the additional function of specification.

Specification, as a mode for assessing cause through interviews, has been explicated by Komarovsky (1955) under the rubric of "discerning." It is used to evaluate statements of causality given by respondents for their actions, in accordance with Lazarsfeld's prescriptions in the "Art of Asking Why." Komarovsky applied the method to the effects of unemployment during the depression on marital relationships.

Discerning involves three steps:

1. Preliminary checking of the evidence to make it more specific and complete.

2. Checking the evidence for its consistency with other situations in the life of the respondent and, generally, with human reactions observed in similar situations.

3. Testing the possible alternative explanations of the change. The criteria in the third step are once again the relative consistency of one or another explanation with what is known of the life of the respondent and with general knowledge concerning human behavior in similar situations.

The first step, checking the evidence, involves questioning a person to determine if all relevant explanations, as experienced by him, for his behavior have been given, and assuming they have, eliciting more detailed statements linking each to the action. Procedures associated with this step were discussed in the last section.

Given evidence of causality, it is checked for consistency in several ways. First, one ascertains if "the alleged causal factor was present in a different situation in the informant's life without producing the action or attitude claimed to be a result of it"(Komarovsky, 1955, p. 451). If such was the case, then we know that the factor was not sufficient to cause the action, although it may have been necessary in the presence of other factors to evoke the action. Similarly, if "the result has existed previously in the life of the informant even when the alleged causal factor was absent" (Komarovsky, 1955, p. 451), then we may conclude that it was not necessary to cause the result, although if it were present it very well might. We can be quite certain that if both of these cases were true, then the alleged factor was not a cause. However, it must always be realized that as the individual and his circumstances change, historical evidence may no longer be relevant. Thus,

it is most important to assess carefully the consequences of time on such inferences, particularly if the elapsed time between events is great.

Such essentially logical tests should be supplemented with checks for the psychological consistency of the respondent's reasons for his action. For example, in Komarovsky's study of unemployment and marriage, she found that "a woman may deny that loss of earning ability has undermined her respect for her husband. This statement may be inconsistent with what is known about her values of life, her attitude towards her husband at the time of marriage, and present behavior towards him" (Komarovsky, 1955, p. 452).

The third major aspect of discerning involves testing for alternative explanations of causality. Under any method of explaining action, one postulated causal factor must be judged against rival hypotheses to determine whether or not it is spurious and if not, whether its relative contribution to the explanation is greater than other nonspurious factors. As manifested in the technique of discerning, the test of each alternative explanation entails scrutinizing plausible alternatives in accordance with the methods discussed above.

Note that discerning does not address the general question of why a person acted as he did. It is directed instead at the more limited concern with whether or not a certain factor can be considered a reason for his action (Lazarsfeld, 1942, p. 38). "To discern whether a certain exposure was the reason for a subsequent action means to judge whether or not the action would have come about without this exposure having been present" (Lazarsfeld, 1942, p. 39). We turn now to an examination of the statistical analysis of reasons in which discerning plays a major role.

Recall that Rossi established the "effectiveness" of various factors on mobility by taking the ratio of percentage of respondents for whom the factor was important (Impact) to the percentage who mentioned the factor at all (Coverage), i.e., Effectiveness = Impact/Coverage. The rationale for this procedure rests in the usual evaluation of effect with cross-sectional data. A common way of assessing cause in survey research involves comparing samples of persons who have and have not performed an act to determine in what ways they differ on presumed causal factors. For example, if you want to measure the effect of advertising on buying a product, you could compare a sample of persons who had been exposed to an advertisement with a sample which had not been exposed to get the difference in proportions having bought the product.

TABLE 5: The Effect of Advertising on Buying

	Exposed to Advertisement	Not Exposed to Advertisement
Bought Product	50%	30%
Did Not Buy	50	70
Total	(1000)	(1000)

For example, in Table 5 we see that 50% of the persons exposed to an advertisement for a product bought it as compared to 30% of those not exposed. The difference between these is 20% (or .20 if expressed as proportions). This difference is commonly taken to be the effectiveness of the advertising, i.e., the proportion of persons in the exposed group for which there was an effect. Our conclusion that they were influenced rests on an assumption that equal proportions from both samples would have bought regardless of exposure to advertising.

This measure of effectiveness is equivalent to the ratio of the proportion of actors for whom there was an effect to the proportion of actors exposed. In reason analysis we deal only with people who have performed some action (buyers in the previous example). Thus we cannot say how many non-actors there are and we cannot compare percentages exposed. We can, however, discern the proportions of actors exposed (coverage) and influenced (impact), and thereby compute a measure of effectiveness. This is how Rossi measured the effectiveness of each proposed factor on mobility.

Assertions about causality made on the basis of reason analysis may be challenged on logical grounds if poorly conceived. In particular, one should never assume that mere possession of an attitude or exposure to an influence is sufficient to cause an act (although it may have done so). For example, a once-popular argument against the legalization of marijuana was that marijuana usage leads to heroin usage -- that marijuana usage is a significant link in the causal chain resulting in heroin addiction. The evidence cited for this was the extraordinarily high percentage of heroin addicts who had used marijuana. But the logic underlying this argument is easily shaken by the observation that virtually all addicts had also previously eaten ice cream. The point is that the truth or falsity of the original claim cannot be supported merely by showing that persons who use heroin had also done something else prior to their narcotics usage. Discerning under a well-structured accounting scheme is a safeguard against fallacious conclusions.

Limitations and Validity

Beyond limitations imposed by the scope of application of reason analysis are those directly related to problems with retrospective interviewing and the validity of assessments. Retrospective interrogation for reasons can only be as effective as a respondent's ability to recall significant events without distortion. Katz and Lazarsfeld found that in about one out of fifteen cases a respondent was totally unable to recall relevant information (1955, p. 203). It is fair to assume that among the other fourteen cases were respondents whose recollection was inaccurate. It is especially unlikely that a respondent could remember psychological factors, including attitudes and sentiments, associated with an act, if indeed he was aware of them at the time. For example, he probably could not remember, "or even know, that he followed a neighbor's advice because he reminded him of a person whom he trusted when he was a child" (Lazarsfeld, 1972, p. 81). A researcher should not rely too heavily on self-reports of respondents. Confidence in the results of a reason analysis rests with the researcher's ability to extract sufficient information from a subject such that he can make his own assessments.

Assuming that information has been skillfully obtained, one question will always remain:

> Would the respondent have attended the movies, or changed her hair style, or bought a new food brand had this influence not been exercised upon her? The answer will always depend on a variety of additional considerations: How likely is it that other influences in the same direction would have taken the place of the one under consideration? How determined was the respondent to take this action? To what extent was the whole situation such that something was sure to create her determination? Obviously, we never have enough information to make such judgments with very great confidence.
>
> (Katz and Lazarsfeld, 1955, p. 205)

But while one may have many mistakes in assessing cause for individual cases, judgments made for the aggregate of subjects are more likely to be correct the larger their number (Katz & Lazarsfeld, 1955, p.206).

Whenever possible, one should try to validate results using either alternative modes of assessment or external information. The researcher and his interviewers make assessments in the course of the research. Following the interviews, information may be further validated by employing a panel of judges to classify the interviews and to evaluate the findings. One should expect their judgments to be very similar to those of the researcher (Smith and Suchman, 1955, p. 409). Finally, statistical results may be validated by comparison with other independent data sources, if available, as is done in any empirical research. For example, additional studies might be conducted or relevant data from other surveys might be compared.

Reason Analysis and Other Modes of Reason Investigation

Only a few examples of reason analysis can be found in the literature of recent years. The most notable is a study on Israeli student immigration by Ritterband (1969). Nevertheless, many recent studies are explicitly concerned with people's reasons for engaging in certain actions. Several of these point to the potential usefulness of reason analysis in current research. Representative studies include research in areas previously investigated under reason analysis: occupational choice (Ashley, et al., 1970; Lindenthal, 1968; Vollmer, 1966) and immigration (Appleyard, 1964).

Social scientists engaged in health-related research seem to be especially interested in the investigation of reasons, if articles in

the Journal of Health and Social Behavior may be considered indicative. Since 1967, articles have included studies on motivations of persons seeking plastic surgery of the nose (MacGregor, 1967), factors in the choice of health care plans (Metzner and Bashshur, 1967), the choice of dentistry as a profession (Shuval, 1970), teenage drinking behavior (MacKay, et al., 1967), reasons for drug usage (Schaps and Sanders, 1970), and needle-sharing among drug addicts (Howard and Borges, 1970). One study published in Psychiatry describes the process of becoming a nudist (Weinberg, 1966) using an approach similar to reason analysis, but without guidance from an explicit accounting scheme and without discussion of how causes were assessed.

These studies typically present reason frequencies, some of which are well analized both statistically and qualitatively. Unfortunately, they fail to make explicit either the logic of analysis or the process of assessment guiding the investigation. Consequently, they are subject to criticism on the grounds of both research logic and the validity of their findings. In the absence of knowledge on how reasons were chosen as causes, we are led to a conclusion reached by Lazarsfeld over thirty years ago:

> What is needed... is precisely a very careful description of how this decision was made, in order to learn what variables were assumed to characterize the case, what laws were applied to make forecasts of a later state of affairs, how safe the prediction was, what alternative possibilities were considered, what assumptions were made about other kinds of exposure prevalent in this group, etc. It is the conviction of this writer that if such an analysis were more freqently carried through, much systematic knowledge about discerning would quickly accumulate. It would then be possible, for example, to classify factors into different groups according to degree of discernibility, to bring out more clearly the difference between impact and effectiveness always underlying such studies.
> (Lazarsfeld, 1942, p. 42)

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